Glasgow
University Library

Ferguson Collection
1921

Ai - b. 37.

Tom Taylor Esq.
with the Author's comp

M

ON

# MINERAL WATERS:

## THEIR PHYSICAL & MEDICINAL PROPERTIES.

*BY THE SAME AUTHOR.*

## A MANUAL OF ELEMENTARY CHEMISTRY;

BEING

A PRACTICAL CLASS-BOOK, ILLUSTRATED.

Post 8vo., cloth, Price 7*s*. 6*d*.

---

ALSO,

## ON THE PATHOLOGY AND TREATMENT OF SCROFULA.

With Plates, 8vo., Price 10*s*. 6*d*.

ON

# MINERAL WATERS:

## THEIR PHYSICAL & MEDICINAL PROPERTIES.

WITH

DESCRIPTIONS OF THE DIFFERENT MINERAL WATERS
OF GREAT BRITAIN AND THE CONTINENT,

AND

DIRECTIONS FOR THEIR ADMINISTRATION.

BY

ROBERT MORTIMER GLOVER, M.D., F.R.S.E.,
MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON;
LATE FIRST-CLASS CIVIL SURGEON IN THE MILITARY HOSPITALS IN THE EAST;
ONE OF THE METROPOLITAN INSPECTORS OF THE BOARD OF HEALTH
IN THE CHOLERA OF 1854, ETC. ETC.

> "O liquidi crystalli, onde s'estingua,
> L'ardente fete a' miseri mortali!"
>
> Tasso, *Del Mondo Creato, Giorn. III. Stanz.* 18.

LONDON:
HENRY RENSHAW, 356, STRAND.
MDCCCLVII.

LONDON:
SAVILL AND EDWARDS, PRINTERS, CHANDOS STREET,
COVENT GARDEN.

GLASGOW
UNIVERSITY
LIBRARY:

# PREFACE.

The author of this work has for many years, without making a special study of mineral waters, kept his attention upon the subject; he has visited a good many of the mineral waters both in this country and on the Continent; he has also been repeatedly employed to make analyses of various waters. Three remarkable works have lately appeared on mineral waters; viz., a work by M. Constantine James on all the mineral waters of the world, and one by M. Herpin, of Metz, on the theory of the subject, without entering into particulars so far as to describe the waters separately; lastly, the first volume of an elaborate German work by Lersch has appeared. These works were reviewed by the writer in the April number of the *British and Foreign Medico-Chirurgical Review.* On mentioning the matter to the publisher of the present volume, it was determined to bring the new information thus accessible with regard to mineral waters before the public; and the result is the present volume.

It will be observed that although the description of Continental mineral waters is based upon the work of Dr. James, the author has in many instances taken a view very different from that writer. There are two or three circumstances which require explanation.

The writer was desirous of saying more with regard to climate than he has done; but really accurate information concerning the climate of watering-places is sadly deficient. In a few instances valuable facts might be stated. Thus, for instance, with regard to the climate of Pau, in close proximity to some of the principal French watering-places, we are told by Dr. Taylor that the atmosphere of Pau is remarkably still; that there is an absence of free communicable humidity, and of great transitions from heat to cold. Such conditions enable the invalid, without risk of sudden chills or the disturbance of the functions of any organ, to enjoy out-door exercise throughout the winter, and account for the remarkable immunity from disease, and the longevity of the inhabitants of Pau. "The inhabitants show a slower circulation, and are more phlegmatic than their countrymen generally; and visitors equally, after a time, exhibit a permanent reduction of their pulse, and a modification of temperament; wherever, therefore, there is nervous and arterial action, the climate may be recommended." Now this is a very valuable statement. The waters near Pau are some of them especially recommended in consumption, so that the patient may pass the winter at Pau, the summer amid the mountain springs. It is very seldom that so clear and definite a statement is to be got.

In giving the analyses of waters, the English are generally given in full; with regard to many of the Continental waters, the author has given the principal ingredients, and not every minute constituent. The explanations with regard to many of the English spas must have prepared the reader a good deal to judge for himself as to how far the constituents of a water account for its properties. Litres are reduced to pints, and grammes in general to grains; Centigrade degrees are reduced to those of Fahrenheit, except in the single instance of the tables taken from the work of M. Herpin, which are simply transferred. In order to convert Centigrade degrees into those of Fahrenheit, it is only necessary to multiply the Centigrade by 9, and divide the product by 5, adding 32 to the result. Thus 10 degrees of the Centigrade multiplied by 9 = 90, divided by 5 leave 18, and adding 32, seeing that the Centigrade begins at 32 of Fahrenheit, we get 50°. Ten degrees of the Centigrade, therefore, are equal to 50° of Fahrenheit.

There is one part of the subject with which the author has experienced considerable difficulty—it is that which relates to the presence of azote in some waters, and its supposed effects. It is certainly remarkable that there should be at least two waters largely impregnated with this gas, or rather, along with which a large quantity of this gas escapes, possessed of properties which appear to be well authenticated out of all proportion otherwise to their constitution. I refer especially to Buxton and Penticosa. On the other hand, the properties of these greatly differ. Buxton water is said to stimulate powerfully, Penticosa to be sedative.

The reader, under the head of Buxton, will find the question as to the share that azote may have in the activity of waters discussed. It would be worth while forcing a quantity of azote into water to try whether it has any physiological action. If it has, like carbonic acid, there can be no doubt about the abundance of the supply; for it would only be necessary to remove oxygen from atmospheric air, about which there could be little difficulty, as there are abundance of deoxidating agents.

Certainly there need be no deficiency of the remedy, if azote do possess any real power; but for the reasons given in the text, I do not believe in its efficacy. In the case of carbonic acid, we taste it in water impregnated with it; there can be no question of its power.

It is meant that this work should be above all eclectic. The writer cannot say, with M. Herpin or Dr. James, that he has systematically visited all the places described; that he has lived at the hotels with the patients, eaten and drunk with them; but he has seen a good many of these waters, and enough to enable him to judge from what he has seen of that which he has not. Surely, in order to write concerning a remedy, it is not necessary to have experienced its effects *in propria persona*, or woe to the unlucky doctor. By a parity of reasoning, I who have seen the breach by which Mohammed the Second entered Constantinople, should be able to describe the assault of Constantinople better than the immortal author of the Decline and Fall, and every sailor should be a better geographer than Malte Brun.

The author has imitated other writers on the subject by interspersing anecdotes here and there along with the more strict matter. He has also imitated other writers in indulging more in personal matters than he would otherwise have done; and has referred more than once to his own labours. In defence of this, however, he may plead, first, as has been said, example; and, in the second place, the fact, that by these references he hopes to give some confidence to the reader, by letting it be seen that he is no new thinker on the matter.

There is one more point to which he wishes particularly to call the attention of the reader. This is the great law that the chemical and physiological properties of bodies are precisely related. It is impossible to exaggerate the importance of this law, especially in the study of mineral waters. Something similar is the case in Botany, where the members of the same natural family of plants possess analogous properties; that is to say, resemblance in external form is attended with similarity of action on the systems of men and animals.

The remarkable chemical analogies between chlorine, bromine, and iodine are particularly cited as accompanied by analogy of action. Observe how close is this analogy. Chlorine has the lowest combining equivalent; then comes bromine, then iodine. Chlorine is a light green gas, bromine a deep red liquid, iodine an intense violet solid. The specific heats of these bodies and their compounds, according to M. Regnault, observe the same kind of analogy. Nay more, according to my friend Dr. Cogswell, even the endosmotic powers are closely related.* Is it not highly interesting to find the same beautiful relation subsist between the physiological and medicinal properties of these bodies? also between manganese and iron, baryta and lead, soda and silver, magnesia and zinc. The reader must recollect, however, that analogy is not identity.

The probability is, that these chemical relations mean fundamental identity of composition; and that if chlorine be A, then bromine is A + B, iodine A + 2 B, and so on. I have pointed out, in like manner, that if to the equivalent of barium we add half its equivalent, we get lead. As another illustration of this invaluable law of relation between the chemical and physiological properties of bodies, we cannot do better than take baryta and lead.

---

* Endosmosis is a power which has much to do with the phenomena of life. It is a law by which a thicker fluid can attract a thin through a membranous partition. By means of this power the sap is supposed to ascend in trees. Now, according to the researches of my friend Dr. Cogswell, the compounds of bromine in solution are intermediate in endosmotic power between those of chlorine and iodine.

Barium, the base of the earth baryta, resembles lead in the first place in its weight. If a piece of the metal, for instance, be dropped in water, instead of floating like potassium, or hardly sinking like sodium, it falls right to the bottom, disengaging bubbles of gas from the decomposed water as it falls. Its compounds, the carbonate and sulphate, closely resemble the corresponding compounds of lead, and they resemble them likewise in properties. Carbonate of baryta is a virulent poison, so is carbonate of lead; sulphate of baryta is inert, so is sulphate of lead. The probability is, that these facts may be accounted for by the muriatic acid of the gastric juice acting upon the carbonates, and not upon the sulphates. Again, both the salts of baryta and of lead act as paralysing agents; but lead affects rather the muscles of the arms and legs, baryta those of the neck.

When I wrote on the compounds of chlorine, bromine, and iodine in 1842, I selected one group of bodies, whose properties were then quite unknown, for examination, viz., the chloride, bromide, and iodide of olefiant gas, chloroform, bromoform, and iodoform, since so well known as anæsthetic agents; and I pointed out the remarkable resemblance between their very extraordinary properties, a result which all experience has tended to confirm. It is now perfectly well known that one of this group of bodies may almost be substituted for another, so close is the analogy.

Observe the great resemblance between the physiological properties of mercury and gold. However, it is not necessary to multiply examples.

Bearing this in mind, the reader may the more easily appreciate the properties of many waters. It may be thought that too much is made here of chemical views, seeing that after all chemistry does not in every instance give the exact constitution of a water. That is true; but still, as far as chemistry does go, it is of immense service. In many instances we can no more form a water by adding its elements than we can form wine by putting together a certain amount of water and organic materials. Some one has said that, in analysing waters, we only dissect their carcases.

It only remains for me to counsel my readers, in the words of M. Herpin's motto—

> "Vos quos languor edax, quos opprimit arida tabes,
> Mergite vos undis, fontes haurite salubres."

# CONTENTS.

## CHAPTER I.

PAGE

Different Opinions concerning the efficacy of Mineral Waters; general Opinion of Mankind in their favour—Practice of the Ancients—Modern Turks and Ancient Romans—Mode in which most Mineral Waters have been discovered—Instincts of Animals . 1—12

CHAPTER II.

Nature and Origin of Mineral Waters—The Sea the chief Mineral Water—Constituents of Mineral Waters, ordinary and more rare—Division of Mineral Waters into Hot or Thermal, and Cold—Causes of Thermality, and of the greater Medicinal Effects of natural Hot Springs over those of ordinary Hot-water Baths—Further Division of Mineral Waters: Gaseous, Carbonated, and Sulphuretted; Alkaline, Saline, Chalybeate . . . . . . 13—33

CHAPTER III.

Medicinal Action of Mineral Waters—Hot and Cold Bathing—The Sea—Sea Air—External Applications of Gas—Mud Baths—Properties of the different Classes of Waters—Selection of a Mineral Water—Climate, Diet, and Regimen . . . . . . . . . . 34—55

## PART I.

### PARTICULAR MINERAL WATERS. MINERAL WATERS OF ENGLAND.

### SECTION A.—MINERAL WATERS NORTH OF THE TRENT.

### CHAPTER IV.

Gilsland—Shap—Shotley—Tynemouth—Croft — Dinsdale — Gainsborough—Butterby—Scarborough . . . . . . . . . . 56—71

### CHAPTER V.

PAGE

Harrowgate—Starbeck—Knaresborough—Aldfield—Hovingham—Thorpe Arch—New Malton—Askerne—Horley Green—Slaithwaite—Ilkley—Hydropathy—Turkish Baths . . . . . . 72—103

### CHAPTER VI.

Buxton, its elevated Site, its History—Analyses of the Water—Attempts to explain its Properties by the presence of Nitrogen—Its Climate—Matlock . . . . . . . . . . . . . . 104—116

### SECTION B.—MINERAL WATERS SOUTH OF THE TRENT.

### CHAPTER VII.

Brine Springs—Woodhall, or Iodine Spa—Tenbury, Ashby-de-la-Zouch, Victoria Spa, Gloucester—Leamington Springs—Cheltenham—Melksham—Epsom—Kilburn—Hockley—Beulah—Hampstead—New Islington, or Sadler's Wells . . . . 118—139

### CHAPTER VIII.

Bath—Romans—Saxons—Legend of Bladud—Characters and Properties of the Waters—Directions for their Use—Roman Bath—Clifton—Malvern—Tunbridge—Brighton—Hastings—Sandrock, Isle of Wight—Bournemouth—Torquay—Climate of the Southern Watering-Places—Dorton . . . . . . . . 140—167

---

## PART II.

### MINERAL WATERS OF BELGIUM AND FRANCE.—SPA.

### CHAPTER IX.

Mineral Waters of the Pyrénées: Eaux Bonnes, Eaux Chaudes, Cauterets, Saint Sauveur, Baréges, Bagnères de Luchon, Vernet, Ax, Amélie les Bains, Olette, Ussat, Bagnères de Bigorre 172—190

### CHAPTER X.

Mineral Waters of the Centre of France: Mont Dore, Bourboule, Saint Victoire, Royat, Allyre, Chaudes Aigues, Vic sur Cère, Vichy, Hauterive, Nèris, Bourbon l'Archambault, Bourbon Lancy, Saint Honoré, Pouges . . . . . . . . . . . . . . . 191—210

### CHAPTER XI.

PAGE

Mineral Waters of the East and other Parts of France: Bourbonne, Plombières, Luxeuil, Bains, Bassang, Contrexville, Vittel—Mineral Waters of divers Parts of France: Barbotan, Castéra Verduzan, Rennes, Campagne, Balaruc, Cransac, Vals, Aix, Provence, Gréoulx, Uriage; curious fact regarding the Roman Bath—La Motte, Saint Galmier, Saint Alban, Charbonnière, Niederbronn, Saint Amand—Mud Baths: Forges, Passy, Auteuil, Enghien 211—236

## PART III.

### MINERAL WATERS OF GERMANY.—MINERAL WATERS NEAR THE RHINE, AND THOSE OF OTHER PARTS OF GERMANY.

### CHAPTER XII.

Mineral Waters near the Rhine: Aix-la-Chapelle, Kreuznach, Ems, Selters, Schwalbach, Schlangenbad, Wiesbaden, Weilbach, Soden, Kronthal, Hombourg, Nauheim, Baden-Baden, Wildbad . 238—266

### CHAPTER XIII.

Kissingen, Bocklet, Bruckenau, Heilbrunn, Gastein, Gleichenberg, Ischl, Baden (Austria), Karlsbad . . . . . . . . . . 267—289

### CHAPTER XIV.

Pyrmont, Marienbad, Franzensbad, Toeplitz, Bilin, Pullna, Saidschutz, Seidlitz, Frederickshall . . . . . . . . . . . . . 290—302

### CHAPTER XV.

Mineral Waters of Switzerland, Savoy, and other Foreign Countries: Aix (Savoy), Saint Gervais, Evian, Lavey, Leuken, Weissemburg, Pfeffers, Tarasp, Baden (Switzerland), Birmenstorf, Schinznach—Other Foreign Waters: Penticosa, Acqui, Lucca, Monte Catini . . . . . . . . . . . . . . . . . . . . 303—328

## PART IV.

### MINERAL WATERS OF SCOTLAND AND IRELAND.

PAGE
Dearth of Irish Spas.—Scotch Spas—Pitkeathly, Dumblane, Moffat, Airthrey, Strathpeffer . . . . . . . . . . . . . 329—339

---

## PART V.

### MISCELLANEOUS MATTERS.

Diseases in which Mineral Waters are likely to be employed—Analyses of Mineral Waters—Carbonic Acid as a product of nature—Confervæ in Mineral Waters . . . . . . . . . . . 340—368

---

## LIST OF PLATES.

PAGE
Spa . . . . . . . . . . . . . . . . . . . . . . 169
Cauterets . . . . . . . . . . . . . . . . . . . . 175
Bagnères de Luchon . . . . . . . . . . . . . . . 182
Vichy . . . . . . . . . . . . . . . . . . . . . 196
Niederbronn . . . . . . . . . . . . . . . . . . 231
Aix-la-Chapelle . . . . . . . . . . . . . . . . 238
Aix (Savoy) . . . . . . . . . . . . . . . . . . 304

# INTRODUCTORY CHAPTER.

Exaggeration and Scepticism on the Subject of Mineral Waters and their Effects.—Proofs of the Efficacy of Mineral Waters.—General Diffusion of the Belief in their Efficacy.—The Roman and other Nations.—Curious Facts regarding the Discovery of many Mineral Springs.—Instinct of Animals.—Temporary Popularity of Weak Springs.—Permanent Reign of those whose Chemical Composition shows them to be possessed of Active Agents.—And of Thermal Springs.—Question as to the Causes of the Advantage of them over ordinary Baths of the same Temperature.—Akenside.

Few subjects connected with medicine are more interesting to the general reader than that of mineral waters. The circumstances attending their administration, the natural mode of their production, the scenery in which they are often placed, and the associations frequently surrounding them, combine to give them, as remedies, an interest exceeding that of ordinary medicinal agents. Hygiène and medicine, in the narrow acceptation of the term, join hand and hand at the salubrious fountain. Besides this, there is a certain mystery connected with the origin and mode of operation of some of them, which with many is attractive, just as in the extraordinary doctrines of Hahnemann and others. Many of these waters, and especially the thermal ones, produce effects, in general estimation at least, far beyond what can be accounted for, either by their chemical composition and the power of their *known* constituents, or by their temperature as indicated by the thermometer, in comparison with those of ordinary water baths.

All these circumstances have given rise to much exaggeration on the one hand, and scepticism on the other, with regard to the effects, real or supposed, of mineral waters. Spas have been exalted, and are still exalted, by interested parties as panacean cures for all diseases, others unworthily decried; source has been pitted against source, and pump against pump; and battles fought between rival spa-doctors, which only tended to raise doubts in the opinions of thinking men.

For the efficacy of mineral waters generally, many reasons may be given; as the universal belief of mankind, and actual facts which cannot be overlooked. That a great many waters exist, whose chemical composition shows them to be possessed of great medicinal energy, abundant evidence will be adduced to show. That fashion, caprice, and false medical testimony have unduly, for a time, popularized some springs, will be admitted; and the sinking of these into oblivion vindicates the just renown of others. Finally, it will also be admitted that there are especially thermal springs, whose undoubted powers are a problem at present to a great extent, the solution of which, however, will be attempted, as far as the known facts or theories admit of it.

It is an undoubted fact, that many excellent remedies have been discovered by a kind of fortuitous accident, or the instincts of men and animals; and one eminent writer* has gone so far as to maintain that practical medicine has gained more in this way than by all the labours of eminent physicians; but this is pushing the matter too far,—a species of accident or instinct, in the first place, has done much for the discovery of remedies, and progressive science, refining upon experience, has done more to bring them to perfection and employ them properly. What a kind of instinct can do in teaching men the powers of either remedial or destructive agents from the kingdoms of nature, may be seen from the mode in which the otherwise powerless Bushman has provided himself with his poisoned arrow; what accident can do, in the discovery of cinchona.* The history of mineral waters abounds with such facts, some of which seem worthy of being related.

---

* M. Renouard.

But first, of the general belief in the efficacy of mineral waters. It is evinced in the practice of all nations, from the conquering Roman to the modern Turk, or the roving red Indian, led by instinct to the springs of Saratoga. The Roman, in the language of the author of "The Brunnens," had a keen scent for thermal waters. Their readiness to avail themselves of these natural resources, and their sense of the superiority of them over ordinary thermæ, is shown by many facts. In this country they availed themselves of Bath and Buxton; in Germany, as far as they proceeded, they utilized the thermal springs. In France, at Luxeuil, there is still remaining an inscription—

LIXOVII. THERM.
REPAR. LABIENVS.
IVSS. C. IVL. CAES.

So that, almost immediately after the conquest of this *eastern* part of Gaul, one of the first acts of the conqueror was to order his lieutenant, Labienus, to repair the fountains of Lixovium, which thus clearly also had been previously in use among the Gauls. This also renders more probable the tradition which carries back the use of the waters of Bath to the ancient Britons. Nay more, there is, or was until lately, at Luxeuil, near the thermæ, the remains of an aqueduct, over which the road to the baths passes. "It is in Roman masonry, and has yet 231 feet in length by 6 feet 8 inches in height, and ought formerly to have had 700 feet."

---

* It is not easy to see the grounds on which Humboldt discredits the ordinary version of the discovery of this remedy. He says—"In Loxa, I have heard it affirmed that the salutary powers of the tree were long previously, though not generally, known in the mountainous regions." Surely this neutralizes what follows—"Immediately after my return to Europe, I expressed doubts whether the discovery had really been made by natives in the vicinity of Loxa, for the Indians in the neighbouring valleys, where intermittent fevers are very prevalent, have an aversion to the Quina bark."

It was environed by two other aqueducts, whose object was to *carry off other water*, and prevent *any admixture* with the mineral water. In many places the sites of villas appear to have been selected, on account of the presence of the thermal springs. Thus, in the year 1834, the writer bathed in the hot sulphur spring about four miles east of Civita Vecchia, which flows through the ruins of Trajan's villa, near which it issues from the ground hot enough to boil an egg. The old bath, where the Emperor of the world used to recline, still remained, half ruined, but capable of use: the place is described in the Letters of Pliny, who resided there some time with Trajan.

At Bourbonne les Bains, a votive tablet was found, addressed by C. Gatinius to the Goddess Vorvonna, venerated by the Gauls as presiding over baths and mineral springs, for the cure of his daughter Cocilla. And so numerous are the mineral springs in the Bourbonnais, that this goddess is supposed to have given name to the province, and thus to the royal family of France; and they, indeed, were great patrons of these baths.*

In the east, not to speak of other instances, the baths and mineral waters of Mitylene and Broussa have been of repute from the earliest times. It is pleasing to find even one of the most ferocious of mankind seem to venerate these natural sources of health. "Four miles from Castro," Walpole tells us, in his Travels in the East, "we passed a Greek village called Chorous, where there is a hot spring still called Thermia, and over which the great Hassan, the Capudan Pasha, had built a commodious bath, and a khan or lodging-house, for its supposed medicinal properties."

Besides the general belief in the efficacy of mineral baths and waters, many curious facts in their discovery testify to the same effect, and also the instincts of animals.

Thus Bagnoles is a village in the department of the Orne which owes the discovery and reputation of its waters to a very remarkable fact. An old horse affected with disease of the skin and all covered with wounds, was on the point of being delivered to the knacker, when its master, recollecting its good services, determined to abandon it to its fate, which he did in a valley surrounded with rocks. Two months after, the master passing the end of the valley, perceived a horse, which he believed to be his sick horse, come trotting to him and approach him familiarly. He was fat and had a clean skin. Willing to know the cause of so astonishing a cure, the master followed and observed all the movements of the animal, and soon saw it roll itself in mud garnished with evergreen herbs. On putting the hand in this, it was found to be very hot; in fine, the marsh was drained, and sources of hot water, limpid and sufficiently abundant, were discovered.

---

* *Précis Historique sur les Eaux Minérales les plus Usitées en Médecine, etc.* Par J. L. Alibert. Paris, 1824. P. 66.

I cannot deny myself the pleasure of quoting a similar fact, so admirably told by the author of "Bubbles from the Brunnens," with regard to the discovery of the waters of Schlangenbad. "In the history of the little Duchy of Nassau, the discovery of the spring forms a history full of innocence and simplicity. Once upon a time, there was a heifer with which everything in nature seemed to disagree. The more she ate the thinner she got. The more her mother licked it, the thicker and more staring was her coat. Not a fly in the forest would bite her. Never was she seen to chew the cud, but, hide-bound and melancholy, her hips seemed to be actually protruding from her skin. What was the matter with her, no one knew; what could cure her, no one could divine; in short, neglected by her master and her species, she was, as the faculty would term it, given over. In a few weeks, however, she suddenly reappeared among the herd with ribs covered with fat, eyes like a deer, skin as sleek as a mole, breath smelling sweetly of milk, saliva hanging in ringlets from her jaw. Every day seemed to re-establish her health, and the phenomenon was so striking that the herdsman, having watched her, discovered that regularly every morning she wound her way in secret into the forest, until she reached an unknown spring of water, from which having refreshed herself, she quietly returned into the valley."

A young Nassau lady showed symptoms similar to those of the heifer, and the herdsman recommended the water, which cured her.

It is a well-known fact, says Alibert,* that at Vichy, in the month of April, the period at which the snows melt in the mountains, when a certain wind passes from the Puy de Dôme over the fountains, and drives away the vapours to a distance more or less considerable, the ruminating animals which are found on the right bank of the Allier traverse the river, however flooded it may be, to drink greedily of the salutary source of the establishment. It is then that the waters are good—then that the inhabitants of the country say that the season has opened, *les bêtes ont passé.* In these districts, in 1818, there was an epizootic disease; all the animals which could come and drink at the hot fountain of the Hôpital were preserved. Similar observations have been made at other saline springs. Such facts are similar, or rather analogous, to what has been observed at the salt licks of America; and, as in the ordinary state of the animal frame, instinct leads them to the occasional use of ordinary salt, so in disease it may lead them to seek those more rare principles which mineral springs contain, and which are suitable to the changes their systems have undergone.

At Inverleithen,† before the mineral spring there was in use, it was called the "Doo-Well," from the number of pigeons which flocked to it.

Saint Gervais, in Savoy, was discovered by some young shepherds, who perceived their goats lick without ceasing a particular spot where the ground was not so cold as elsewhere, and some water which oozed out was hot, and had a peculiar smell. The thermal sulphurous springs of Barèges were found by attention being attracted to a sheep traversing the snows every morning to the springs.

---

* Op. cit., p. 6.

† As certainly the St. Ronan's Well of Scott, as Fast Castle was Wolf's Crag; but to the last, the author of *Waverley* chose to maintain a certain degree of mystery with regard to the sites of the chief incidents in his novels.

The history of the discovery of the water at Bognes in St. Domingo, is very interesting. According to M. Moreau de St. Mercy, in 1725, a negro keeper of cattle, belonging to a M. Le Clerc, wandering through the savannahs of Port à Piment to collect the cattle of his master, the horse on which he was mounted suddenly fell in a soft and blackish earth, so that it was absolutely impossible to draw the animal out. He went and sought assistance from his neighbours, but scarce was the animal drawn out, when it was found that the holes he had made were full of hot water. The negro had heard of the benefit derived by the whites in France from mineral waters. He took there several of his friends who were paralysed: they got well, and the French Government founded a sanatorium there, which proved of much value to infirm soldiers. Karlsbad was discovered in a similar way, by a stag flying before the Emperor Charles the Fourth and his huntsmen, plunging through a thin covering into the scalding water, and the Emperor's subsequent cure by its baths followed. But the anecdote has been often told.

The following accidental fact may be cited as corroboration of the virtues of mineral mud. In 1807, at Bourbon Lancy, a mason, who had a diseased leg from infancy, was employed to clear the conduits choked up. He worked there for six weeks, when his wounds had completely cicatrized, and after that he always enjoyed good health.

The temporary popularity of weak springs, as in the case of Tunbridge Wells, and their decline, may be contrasted with the constant reputation of Spa and Pyrmont. It is true that the Pouhon at Spa may only be three or four times as strong as the spa at Tunbridge in iron and salts, but the much larger quantity of carbonic acid which the waters at Spa and Pyrmont contain, render their iron more soluble, keep it longer in solution, enable it, in all probability, to enter the blood in a state fitter for activity—cause it to sit easier on the stomach; while the carbonic acid itself is powerfully stimulating, and the water altogether more grateful to the palate. Such waters as those at Harrowgate continue, and will continue, to preserve their reputation. Their power is undoubted, and their constitution proves it. No doubt there is a fashion in such matters. In the middle of last century many waters in the neighbourhood of London were greatly employed, which have fallen into disuse, some of them, perhaps, without sufficient reason. Fashion rules much also in medicine itself.

Taking into consideration the fact that water itself, used externally or internally, cold or hot, in different modes, is a powerful agent—that it stimulates the skin, dilutes the blood, favours the changes which are constantly going on in the body, increases the action of the secretory organs, and, in short, tends to affect the phenomena of life—the accompanying influence of change of scene, favourable hygienic conditions, and so forth, which every one can appreciate, there does not seem much difficulty in accounting for the general good effects of mineral waters. The absurd laudations of some have provoked the sneers of others. Great disappointment has often ensued from the injudicious choice of waters. This is often done, higgledy-piggledy, without consideration, or sufficient knowledge of the subject by medical advisers. The writer, for instance, remembers a case where an old man, in the last stage of asthma and heart disease, made his appearance at a certain spa, where he had been sent by his medical attendant to drink the sulphur water! Instances of this kind are innumerable. To be brief.—Where cold waters have not real medicinal constitution, so to speak, they either soon fall into oblivion, or owe what reputation they enjoy to other adjuncts—the air, scenery, &c. But it is different with thermal waters. Of this class are sources differing, not to say in little, as is often gently said, but, to speak out boldly, in nothing from ordinary spring water, possessing reputations for the cure of particular diseases almost as specifics, at which one is lost in astonishment. Take, for instance, the baths of Pfeffers and Wildbad; their temperature is about that of the body, or a little lower; their composition about that of pure spring water, yet they have astonishing reputation for the cure of particular affections. Gastein resembles the others in its purity; but the temperature is higher, and has to be reduced before the water is used. Not to speak of the more extensive classes of diseases in which these waters are used, which will be referred to under the heads of the particular spas, let us confine ourselves to a few specimens. Thus, Wildbad is more recommended in gout attended with the deposit of chalk-stones, or a tendency that way; Pfeffers, in gout, in people of weak habits, having a tendency to pass from organ to organ; in palsy of one half the body after apoplexy, and in palsy with the absence of sensibility; while Gastein is more recommended in irregular and depraved nervous action, based on weakness. When any doubt is expressed on the subject of the superiority of these waters, either taken internally or applied externally, over ordinary water with the same adjuncts, one is answered in a way to which with a sceptic there can be only one reply, viz., a shrug of the shoulders. But, on the other hand, it may be plausibly said, send your gouty, or rheumatic, or paralysed patient to Naples, or Germany, or Norway; let him drink as much common water, and bathe in as much common water, as he likes, will he come back cured, as from Pfeffers, or Wildbad, or Gastein?

The following is quoted from an excellent writer, the author of the most recent publication on mineral waters.* "At the commencement of my investigations and of my inquiry, and whilst I was yet under the influence of a scepticism a little exaggerated, I had often to put down on my notes irrefragable facts of cases in formal and complete contradiction with the opinions that I had formed in advance on the effects of the waters.

---

* *Etudes Médicales et Statistiques, sur les Principaux Sources d'Eaux Minérales de France, d'Angleterre et Allemagne, etc.* Par le Docteur C. J. Herpin de Metz. Paris, 1856.

"If I said to a fellow-practitioner, I cannot in truth believe such and such effects, as you record in your works; there is then either evident error, or exaggeration on your part,—'Come with me, then, to such and such a place, and you will see; and you can yourself question the patient, and you will find something more extraordinary still;' and that was true.

"At Bains (Vosges)"—this is a thermal spa—"after a discussion, in which I had disputed with Mr. Bailly (the inspector) many of the properties which he ascribed to these waters, which are very slightly charged with mineralizing principles, I ended with saying, Your waters are only pure waters, and you only behold things through the prism of illusions, a lady happened to pass in the street. 'See, however,' said he, pointing her out, 'one who has derived great relief from our waters. Come and see them.' We approached her, and at the question which I addressed to her to know if the waters of Bains had been really useful to her, 'Ah, sir,' said she, 'it is a miracle, the manner in which these waters have cured me.'" The case had been one of hysterics, accompanied with severe convulsions; and all the symptoms of the affection to which she had been for a long time a prey had disappeared in about fifteen days of treatment. In this country, Buxton is one of these waters, differing in no very clear respect from ordinary spring waters, excepting in its temperature (for Bath is in all respects a mineral water as well as of high temperature), yet the temperature is only 82°, and the water requires to be heated for many patients; yet it seems impossible to doubt the powers of Buxton. The great dilution of the solids in some of these pure waters has often, by the most eminent writers on mineral waters, been adduced in favour of their superior activity, enabling them to enter the pores, and when swallowed allow of their entrance into the system more readily; but the same authorities never fail, when a water possesses really superior strength, to admit and praise this superiority. This is a point on which a little more will be said hereafter. In the next chapter, in discussing the nature and origin of mineral waters, it will be inquired how far this mysterious superiority of thermal natural waters over ordinary hot-water baths may be connected with the origin of the former.

There is one point in favour of the natural baths,—patients who repair to them are more punctual in the use of them, and continue them for a longer period than they could be persuaded to do in the case of ordinary baths, besides matters of hygiène. At Leuk, in the Valais, it is the custom for parties to remain four hours at a time in the bath, a practice in itself, as Sir John Forbes remarks, likely to produce a powerful effect on the skin. But there is an anecdote related by Alibert of an honest Swiss countryman, aged forty-five years, who came to the baths sustained by two sticks, and having, as he said, only ten days to remain there, he took the resolution of remaining ten hours each day in the bath without interruption: to the great astonishment of all the spectators, he continued this courageous conduct. He ate every morning in the bath some good soup with cheese, and accompanied it with a bottle of wine. He renewed the same dose after mid-day. At the fifth day an eruption appeared on the skin, which became rough like the bark of a tree. At the eighth day the eruption disappeared; and on the tenth he only halted a little on one foot.

To resume.—It has well been observed by M. Patissier—"The waters cure sometimes, relieve often, comfort always," that is, of course, when not improperly used. The science and poetry of the subject have been summed up in the beautiful lines of Akenside—himself a physician, who has a niche in the temple sacred to the departed worthies of his profession, and eminently the poet of science—in his Hymn to the Naiads:—

* * * * * "The learned Pæon. Oft when all
His cordial treasures he hath searched in vain;
When herbs, and potent trees, and drops of balm
Rich with the genial influence of the sun,

(To rouse dark Fancy from her plaintive dreams,
To brace the nerveless arm, with food to win
Sick appetite, or hush the unquiet breast
Which pines with silent passion) he in vain
Hath proved; to your deep mansions he descends.
Your gates of humid rock, your dim arcades
He entereth, where impurpled veins of ore
Gleam on the roof; where through the rigid mine
Your trickling rills insinuate; there the god
From your indulgent hands, the streaming bowl
Wafts to his pale-ey'd suppliants; wafts the seeds
Metallic and the elemental salts
Washed from the pregnant glebe. They drink: and soon
Flies pain: flies inauspicious care: and soon
The social haunt or unfrequented shade
Hears Io, Io Pæan; as of old,
When Python fell."*

---

* Apollo (Pæon) the god of medicine's victory over Python, a monster bred from slime (pestilence), may be considered symbolical of the triumph of medicine over disease, according to Lord Bacon's mode of explaining the fables of the Greek mythology.

# CHAPTER II.

Nature and Origin of Mineral Waters.—The Sea, the chief Mineral Water.—Constituents of Mineral Waters, ordinary and more rare.—Division of Mineral Waters into Hot or Thermal, and Cold.—Causes of Thermality, and of the greater Medicinal Effects of natural Hot Springs over those of ordinary Hot-water Baths.—Further Division of Mineral Waters:—Gaseous, Carbonated, and Sulphuretted—Alkaline, Saline, Chalybeate.

It is not so easy to decide upon what should entitle a water to be termed mineral, as it might appear. One author says, "The term mineral is given to waters of a temperature more or less elevated, and of various taste, escaping from the bosom of the earth, and holding in solution certain principles whose medicinal virtues experience has made known to us." But this is to make the definition depend almost entirely upon our opinion of the medicinal qualities of the water, which experience has proved may be very faulty indeed. The more simple definition seems to be that they are springs holding an unusual amount of mineral matter in solution, or gaseous principles not generally found in large quantities in springs, or that they are of an unusually high temperature.

All natural waters are more or less impregnated with other substances. It is even a matter of some difficulty to obtain perfectly pure distilled water. Rain-water when it falls is not quite pure, containing a little nitric acid, or this combined with ammonia, which may be produced in the atmosphere by electrical phenomena; nay, even iodides have been detected in it. The quantities of salts in spring waters are generally greatest in those which arise in low situations. In the higher regions, and from the more primitive rocks, the ordinary springs are generally purest, although in such regions, as will be shown, occur several mineral springs chiefly thermal.* What is an unusual quantity of solids? When a water contains about 5 grains to the pint, or 40 to the gallon, then it begins to assume the character of a mineral water.

Of the mode in which waters are impregnated by mineral matters, any one may form a general idea, viz., by solution from the different strata through which they pass; but there are special agencies at work. It is sufficient for water to dissolve a little oxygen or a little carbonic acid, traces of phosphoric and nitric acids, to act upon compounds which seemed the furthest removed from its action. It is by these simple means, but continually put in play by it, that it disaggregates, in decomposing slowly the minerals which constitute the granites and porphyries, the basalts and all the crystalline rocks, in extracting the silicic acid (silica), the alkalies and earthy bases, and offers them everywhere to organic life, which fixes them in all forms. These bodies in unusual quantities form our mineral waters. Then all organic matters have a tendency to decompose water, to form carbonic acid, and eliminate sulphuretted hydrogen. The same gas is often the produce of volcanic regions, as is also carbonic acid and other bodies. There are other agencies at work, as we shall see immediately in speaking of thermal waters.

The sea is the great mineral water, containing everything soluble that can be washed by the streams containing the produce of the action of water on the globe. And as the sand is the insoluble part of the earth's crust, the two together must be the representation of the composition of the surface of the earth; everything soluble in the sea, everything insoluble in the sand. Of late years, silver, lead, and copper have been found in sea-water.

---

* "The best waters are those which come from high places and hilly grounds, for these are sweet, white, and will bear a little wine—are warm in winter and cold in summer, as coming from the deepest springs."—*Hippocrates upon Waters and Places.*

The following is one analysis of the principal ingredients in water taken in the Channel. In the pint—

| | | | |
|---|---|---|---|
| (Common Salt) | Chloride of sodium | 225·4 | grains. |
| | Chloride of magnesium | 25·470 | ,, |
| | Sulphate of magnesia | 21·646 | ,, |
| | Sulphate of lime | 16·108 | ,, |
| | Bromide of sodium | 0·902 | ,, |

In fact, the only limit to the number of the constituents of sea-water is the extent to which the analyses are carried.

The constituents of mineral waters are gases,—as nitrogen, atmospheric air, rarely oxygen, carbonic acid, and sulphuretted hydrogen; inorganic substances, alkaline, earthy and metallic salts, and certain organic principles. The most common of the salts are the muriates and sulphates of potassa, soda, baryta, lime, alumina.* The carbonates are not so common, at least in any quantity. Salts of strontia, lithia, and manganese are more rare. Silicic acid in small quantity is very common. Boracic acid does not commonly occur: it exists in some waters in such quantities as to be an article of commerce. Copper, arsenic, and phosphorus are sometimes present in combination. The principles bromine and iodine, to whose presence much importance has been attached, are probably present in small quantities in almost all the waters containing the muriates; they are always in combination.† Fluorine is often present in small quantity in combination. Of the organic solids, the principal are crenic acid, derived from the soil often in combination with iron, and of late, acetic, butyric, propionic, and formic acids have been discovered in the water at Bruckenau. To describe these properly would exceed the limits which chemical details should occupy in this work; and to describe them imperfectly would answer no good end. There are, however, some principles to which importance has been attached of a peculiar character, and which would seem to call for more minute description.

---

* The general reader is to understand that the chloride of sodium is the same as the muriate of soda—common salt. It is almost always, in analyses of mineral waters, called chloride of sodium; but, in point of fact, it would be more correctly called a muriate or hydrochlorate, since in solution all chlorides become hydrochlorates or muriates, as they were formerly called.

† As elementary bodies are grouped according to certain strong analogies, which lead us to believe in their ultimate identity, as chlorine, iodine, and bromine, sulphur and arsenic, iron and alumina; so it will be found that in mineral waters these bodies are very apt to be associated together. The same chemical analogies lead to the exercise by these bodies of analogous properties on the systems of men and animals, and those analogies are closely imitated by their compounds. Thus all the salts of baryta and lead are analogous, so are those of iron and manganese. This law is of immense importance in studying the action of remedies.

In a great number of waters a substance is to be found whose nature seems not exactly defined, so that it has been termed "organic-vegeto-animal." It is of a greyish colour, greasy, amorphous, gelatinous, translucid, and has been called zoogine, baregine. In some waters it exists in great quantity, and has been found to be composed of infusoria in great part. In several waters there has been observed an odour as it were of broth (Sir F. Head compares the Kochbrunnen to chicken broth, like others).* This odour is attributed to the zoogine. Whence this substance comes, has been a very disputed matter; and in fact, proceeding from the bowels of the earth, it gives rise to strange conjectures. When put on hot coals, it burns, giving off a smell like burnt horn, and disengaging ammonia—proofs of its animal origin. Some say it is the result of an exudation, or of the decomposition of vegetables, such as confervæ; and we shall see that many mineral waters contain confervæ as well; others, that it comes from the saturation, steeping, or lixiviation of organic matters buried in the bowels of the earth—animal remains, in short (and of this opinion seems the author of the Bubbles), overwhelmed in the various convulsions to which the earth has been subject. It is well known that vast quantities of phosphates have been derived from such remains, and been used in agriculture—why not, at greater depths, the more animal matter? According to others it arises from the animalculæ which are abundantly found in such waters. Others say that it has been obtained by waters from the surface carrying it into the mineral waters. Why, then, is it not found in all waters? Others, again, will have it that this substance is only formed when the waters come to the surface, under the influence of air and light.

---

* The amusing description by Sir Francis of the effects of the Nassau spring will well repay perusal.

Another substance, which has been found only in sulphurous waters, and especially in those of the Pyrenees, is called *sulfuraire;* it is organized, and is in fact a conferva formed of filaments about four lines in length and about one-thousandth of a line in thickness, or less. They are tubular, and have globules in their interior. They are coloured by sulphuret of iron. This substance only exists in waters below 113° Fahrenheit. Both *baregine* and *sulfuraire* contain iodine. A plant called *anabaine* exists in the waters at Dax and Néris. It is of a fine green colour, and is formed of large membranous tubes filled with vesicular globules, and of which some here and there are larger than others, and allow gas to escape. These filaments are held together by a gelatinous substance, which is used as a cataplasm.

Calothrix nivea (conferva) is found in the sulphur springs of Yorkshire, Durham, and Aix-la-Chapelle. The same, or an allied species, was found by Dr. Daubeny in the hot sulphur springs of Gréoulx, in Provence. Oscillaria labyrinthiformis, the Tremella thermalis of some writers, is one of the most common species in the hot sulphur springs and other thermal waters of Germany, France, and Italy. In the Karlsbad waters, sphærozyga jacobi, and several species of oscillaria, have been detected. Humboldt found oscillaria callida in the thermal waters of New Granada. At Vichy, in the basins, are found several oscillariæ and cryptogamic plants.

Conferva tenuissima is found in the hot springs of Bath.

The discovery of arsenic in mineral waters (and it has been found in above thirty, or perhaps forty in France and Germany), might at first cause some inquietude; but in fact the entire question with regard to a poison is as to the degree of its concentration,* and the quantities found are such as to disarm all fear, even if the constant use of these waters, without accident, were not in itself sufficient for that purpose.

It must be recollected that chemical analyses do not give the exact constituents of the water as existing in it, they only give the bases and the acids; these are afterwards combined according to certain theoretical rules, as they are supposed to exist in the water.

Of the gases found in waters, the only ones to whose presence importance can be attached, are the carbonic acid and sulphuretted hydrogen.

The active essential mineralizing principles of waters are very few in number—

They are the sulphates of soda and magnesia;

The hydrochlorates of soda and lime (or muriates of soda and lime, or chlorides of sodium and magnesium);

The carbonates of soda, magnesia, and iron;

The sulphurets of sodium and calcium;

Carbonic acid and sulphuretted hydrogen.

But many powerful agents must be thought of as occasionally present—the muriate of magnesia, sulphate of iron, perhaps the sulphate of lime, and many others of occasional occurrence. To the bromides and iodides of sodium, and perhaps calcium, to which in general much importance has been attached, I give very little, when the quantities are minute, for reasons which I shall forthwith produce.

The usual great division of waters is into hot and cold.

The heat of springs is usually that of the mean temperature of the atmosphere.

In Scotland, near Edinburgh, it is 45°; in the North of Ireland, 48°; South of Ireland, 51°; South of England, 48°; Upsal, 43°; Paris, 53°. It may be presumed that any water with a temperature above this is to be considered thermal. But we cannot call such springs as that at Mallow, in Ireland, 70°, or the Clifton *hot* wells, hot. With difficulty should we give the title to Buxton, 83°. A hot spring is one which approaches or exceeds blood heat, 98°.

---

* The writer, several years ago, killed rabbits and frogs by means of theine or cafeine, the active principle of tea and coffee. Fifteen grains introduced into the stomach of a rabbit, and one grain into that of a frog, were fatal.

The question of the origin of thermal springs is closely connected with that of the mode in which the superior medicinal action of hot springs over ordinary hot baths is brought about; for really the evidence in favour of this superiority seems overwhelming. The advocates of the superior effects of the thermal springs have argued as if there was some difference between the natural heat and the artificial. Dr. Granville always reasons so, and Dr. Sutro quotes with applause the words of Paracelsus—"Heat may have a various entity in itself; the heat of the sun is one, that of dung another. * * * * What great things may be performed by congenial heat is shown by the hens brooding their young with it." The illustration is unfortunate, for artificial heat does the same in Egypt, and Captain Cunningham informs us, writing of Manilla—"Vast quantities of poultry are here reared in a manner differing widely from that commonly adopted in Europe. I have been assured that the art of hatching eggs is constantly practised, and with the greatest success, by the young people of both sexes, who, for the sake of gain, do not scruple to resort to this tedious, and to say the least of it, monotonous employment."*

Those who have maintained the superiority of the heat of thermal springs have not always put their views in an intelligible form; but when it was stated, as at one time, that these waters took a longer time to cool than ordinary spring water heated to the same temperature, the statement meant that the two possessed unequal latent, or rather specific heats.† It was positively stated by one writer that, while a portion of thermal spring water took thirteen hours to cool down from a certain temperature, ordinary spring water heated to the same point was only nine hours in sustaining the same loss. A M. Longchamps, charged by the French Government to examine chemically the mineral waters of that country, performed a series of experiments which it is unnecessary to quote, but which completely established the fact that thermal water cooled precisely in the same time as ordinary water heated to the same degree. "Nevertheless," says Alibert, "there are things which it is difficult to account for; thus at Bourbon l'Archambault and other places a temperature of 60° Cent. (148° Fahr.) does not prevent the drinking of the waters, and does not alter in any manner the most delicate vegetable substances, so that a rose or any other flower may be thrown in or inverted without losing its freshness. It is thus that many bathers support this very temperature at its height, which they could not do with the baths of our cities."* There must have been an error with the thermometer used, for the thing is impossible. Anglada maintains, on the other hand, that thermal waters do not differ in any respect from

---

* "Recollections of an Aide-de-Camp." Vol. II., p. 179.

† By latent heat is meant a quantity of heat which a substance gives out in passing from any one form to another, and which it requires in such a case to regain, in order to resume the first form, the heat being absorbed,

---

and not sensible to the thermometer. Thus water at 32°, and ice at 32°, do not contain the same quantities of heat; but on freezing, as can be ascertained by experiment, it gave out a certain quantity of heat, and, on resuming its form of water, it must reabsorb its heat, which goes merely to effect the change of form. It is the same when water becomes steam, it requires heat to pass into the state of steam, which is given out when it becomes water again, without evidence to the thermometer, that steam contains more at 212° than water at the same. Specific heat is among different bodies what latent heat is to the different forms of the same body. Thus mercury and water at the same temperature contain unequal quantities of heat, the water most. It will take more heat to heat water to a certain point than to heat mercury, and the latter will sooner cool down.

* It is stated, in a paper on the "Functions of the Colouring Matter of the Negro Skin," (*Edinburgh New Philosophical Journal*, October, 1840,) by the writer, that water begins to scald at about the temperature 120°. At about 160° albumen coagulates, when, of course, water becomes *physically* destructive to the tissues. At Broussa is a celebrated fountain called Kurkutlus, which has a temperature of 198° Fahrenheit. To this the Greeks perform a pilgrimage twice a year, in commemoration of the martyrdom of St. Patricius, who, according to tradition, was thrown into the reservoir which receives the scalding water of this source, to punish him for having refused to sacrifice to the gods.

ordinary waters heated to the same temperature, as regards their effects on animals or vegetables. "How is it," he asks, "if these waters differ so from ordinary waters, that they are made to subserve all domestic purposes, as at Arles, where they scald pigs with them. * * * * At Arles the commune has had a basin, called 'Bain des Cochons,' constructed for this very purpose." *

If, then, this explanation by latent or specific heat fails—the fact of the superior efficacy of thermal springs being admitted—is there any other explanation? It must always be borne in mind that there is no question as to such waters as Karlsbad, or perhaps Bath, which contain, the former very large, and the latter considerable, impregnations of saline matters, or, perhaps, even of the Kochbrunnen and others, with their baregine. These, no doubt, are included so far as their thermality is concerned, but we recognise in them *something* besides which may possess power; the question relates to thermal waters almost absolutely pure, but whose medicinal powers are universally admitted. The mind naturally reverts to electricity, and on this point some very interesting and ingenious views have been brought forward. But this is connected with the mode of origin of thermal springs, regarding which there are conflicting opinions.

Besides the water which descending in rain flows directly into the ocean, there are courses of underground water whose destination has not been discovered. Such underground streams may be found on boring at great depths even near the sea-shore. I found the other day the following curious triad in a poem of Taliesin, translated in *Davies' Mythology and Rites of the Druids*. It may be taken as a remnant of the natural philosophy of the Druids; for there can be little doubt that they transmitted their lore to the Bards after the introduction of Christianity, and that Taliesin was a Druid. Besides, there is good reason for believing that the west of the island was never thoroughly subdued by the Romans. If it had been so, the Welsh would not have spoken a pure Keltic tongue. Every other nation conquered by the Romans spoke "Romance." The lines are not to be despised in themselves, and show a very correct idea of the origin of springs.

---

* Anglada—*Histoire Générale des Eaux Minerales Sulphureuses.* Paris, 1837. Plombières is by some supposed to have derived its name from the use still made of its waters to strip fowls,—*plumaria*—*plumières.*

"THE NAMES OF THE THREE FOUNTAINS THAT SPRING FROM THE MIDDLE OF THE DEEP.

"One is the increase of salt water,
When it mounts to aloft,
Over the fluctuating seas,
To replenish the streams.

The second is that which innocently
Descends upon us;
When it rains without,
Through the boundless atmosphere.

The third is that which springs
Through the veins of the mountains;
As a banquet from the friendly rock,
Furnished by the King of kings."

On the other hand, a filtration must doubtless be going on from the bed of the sea into the interior of the earth, where vast magazines of mineral principles, perhaps uncombined as yet, may be stored up; and as water will support the combustion of substances like potassium, even better than air, there is here alone a sufficient cause both of the phenomena of volcanoes and thermal springs. The ejection of fish from volcanoes during eruptions seems a proof that something of the kind takes place. There is here then a sufficient cause, it has been argued, for thermal springs. But to quit discursive reasoning, and bring the various views to a bearing, they may be summed up as follows:—1st, The Artesian theory, which deduces the origin of thermal springs from the internal heat of the earth; 2ndly, The Volcanic theory; 3rdly, The theory which ascribes them to Chemical action; and 4thly, The theory of internal Electrical currents.

1st, The Artesian theory. The recent facts made known through the formation of Artesian wells show that the temperature of the earth increases in the proportion of 1° 8′ Fahrenheit for every 101 English feet. The ascent of the water in Artesian wells is doubtless owing to its descent through the chasms of strata from higher levels; on penetrating these, at a lower level, the water mounts, through hydrostatic pressure. This view was supported by such high authorities as Berzelius and Laplace. At least their idea was, that the ascent of hot water from the interior of the earth was the result of its displacement by cold water of higher specific gravity. "If we conceive," says Laplace, "that rain waters, in descending into the interior of an elevated plateau encounter in their movement a cavity of 3000 metres* in depth, they will fill it at first; then acquiring at this depth a heat of a hundred degrees at least, become by that lighter, they will rise, and be replaced by the higher waters, so that there will be established two currents of water, one ascending, the other descending, perpetually maintained by the internal heat of the earth. These waters in coming from the interior part of the plateau will evidently have a heat much superior to that of the air at their point of exit." One general circumstance seems to bear against this view, viz., that these thermal springs do not bear any relation to the elevation.

2nd, The Volcanic theory. In support of the volcanic origin of thermal springs, it is urged that most of them occur in volcanic regions, or in the neighbourhood of extinct volcanoes, and that their constituents, as carbonic acid, sulphuretted hydrogen, etc., are such as are evolved from volcanoes. Lyell says—"They rise through all kinds of rock, as through granite, gneiss, limestone, or lava, but are most frequent in volcanic regions, or where violent earthquakes have occurred at eras comparatively modern." The water "issuing from them is generally more voluminous, and less variable in quantity, than that proceeding from other sources." In many volcanic regions jets of steam issue from fissures at temperatures high above the boiling-point. "Now, if such columns of steam, which are often mixed with other gases, should be condensed before reaching the surface, by coming in contact with strata filled with cold water, they may give rise to thermal and mineral springs of every degree of temperature. It is, indeed, by this means only, and not by hydrostatic pressure, that we can account for the rise of such bodies of water from great depths; nor can we hesitate to admit the adequacy of the cause, if we suppose the expansion of the same elastic fluids to be sufficient to raise columns of lava to the lofty summits of volcanic mountains. Several gases, the carbonic acid in particular, are disengaged in a free state from the soil in many districts, especially in the regions of active and extinct volcanoes; and the same are found intimately combined with the waters of all mineral springs, both cold and thermal. Dr. Daubeny and other writers have remarked not only that these springs are most abundant in volcanic regions, but that when remote from them, their site usually coincides with the position of some great derangement of the earth's surface, a fault, for instance, or great fissure, indicating that a channel of communication has been opened with the interior of the earth at some former period of local convulsion. It is also ascertained that at great heights in the Pyrenees and Himalaya mountains, hot springs burst out from granite rocks; and they are abundant in the Alps also, these chains having all been disturbed and dislocated at times comparatively modern, as can be shown by independent geological evidence."

---

* The metre is 3 feet 3·7 inches English.

In support of this volcanic theory, the effects of earthquakes on thermal waters have been brought forward. Even when these have taken place in countries far removed from the mineral sources, the latter have not the less been affected by the perturbation. Some waters have been altered in their quality, others in their quantity; some have been stopped, others increased in volume. In 1660 an earthquake took away the heat altogether for a time from the source Reine at Bagnères de Luchon. Sometimes these waters have entirely disappeared for a time, to re-appear modified in their qualities on the occasion of such phenomena. On the 26th July, 1805, the Karlsbad waters disappeared during several hours at the period of the earthquake of Icernina. In 1809, the Sprudel, and the other sources at the same place, experienced the most remarkable alterations. The Schlossbrunn disappeared altogether, and did not re-appear till 1823, but with a different temperature. At the period of the earthquake of Lisbon, 1755, while the waters at Bagnères de Luchon became augmented in temperature, those of Aix, in Savoy, became cold, as did those of Bagnères de Bigorre. At the same time at Néris, and at Bourbon l'Archambault, the volume of the sources was prodigiously augmented. At the latter place the water became of a dirty red colour, and the heat much augmented, while the taste became acid and alkaline. The earthquake occurred on the 1st of November, and the water was not restored to its ordinary state till the 4th. The same day, between eleven and twelve o'clock, the waters of the chief source at Toeplitz, in Bohemia, became at first troubled, then of a dusky yellow and very thick, then they ceased to run for some minutes, when they rushed out with great violence; the water, at first of a reddish-yellow colour, was some minutes before it regained its ordinary character. On the same day a violent agitation was observed in mineral waters generally.

In 1768 the sulphurous waters at Baden were violently agitated at the same time with an earthquake. But it is needless to multiply examples. All this, however, seems rather to tend against the volcanic theory, and to prove that, if thermal springs depended on volcanic agency, they would not be so regular in their flow and in the maintenance of their temperature and other qualities. This does not apply so forcibly to extinct volcanoes. But some of these spas occur in non-volcanic regions; Bath for example. One is inclined, when thinking of the regularity of these springs, to say with Galen, that Vulcan and all the Cyclops who form his train, are without ceasing occupied in feeding the fire of their subterranean furnaces, to keep up a temperature so equal and so constant!*

3rd, The Chemical theory. Chemical action is no doubt a source of heat; but then there is no connexion between the amount of contents in these waters, and their thermality.

4th, The Electrical theory. Humboldt pointed out long ago, near Heidelberg, a mountain formed of schistus chlorite and serpentine, possessing magnetic polarity acting at more than twenty feet on the compasses of the miners, constituting a kind of electro-magnetic apparatus independent of the magnetism of the globe, whose axes were disposed at right angles with regard to the magnetic meridian. He also discovered near Voisaco, in the Cordillera of the Andes, and at a great height, a rock of trachytic porphyry, offering on a small scale the same phenomena as the magnetic rock in Germany. The same rock, endowed with the same principle of activity, drew the attention of the same able observer, as well as of M. Bonpland, on the east side of Chimborazo. The activity of these kinds of electro-motive apparatus has appeared subordinate to the influence of the electric powers of the globe, especially to that of earthquakes, and Becquerel has proved experimentally that it was enough to pass an electric current through a little cartridge of paper, filled with peroxide of iron, to produce a distribution of magnetic forces similar in all respects to that observed in the mountain of Heidelberg.† Now we know the power of electrical currents not only to evolve heat but to produce chemical decomposition. May not then the earth in its interior, in some parts by its stratification, resemble a kind of voltaic pile? And in this way everything connected with the thermality of mineral waters would be accounted for—the constancy of the action in general; its occasional interruption by such phenomena as earthquakes, rending, as it were, the pile in parts; the chemical composition of the waters, their heat, and, it may be suggested, the peculiar nature of their action on the human body.

---

* The thermal waters of Mariana were found by Boussingault to have a temperature of 64° after an earthquake, which, in 1812, destroyed the city of Caraccas, while Humboldt formerly found them only 59° Cent., a difference of 9° Fahrenheit.

Many phenomena might be noted in connexion with thermal springs. Those of Malon, Herault, increase sometimes in volume with a kind of noise and tumult, bringing with them a red matter at the same time, raising the temperature from 95° to 113° Fahrenheit. After some duration, the phenomenon ceases, and the source returns to its former state.

† Anglada.

As water is a good conductor, springs which have their sources deep in the earth, must become charged with some of the electricity which reigned there, and in their turn impart some portion of it to bodies immersed in them, if they have not already imparted it in their course to the conductors they have met with. In water itself the various processes of flowing, pressing, and friction are sufficient to generate electricity. There are not wanting some curious facts connected with the use of baths to support the electrical theory of the peculiar action of mineral waters. Thus Lersch* gives the following case:—"A person affected with rheumatism and difficulty of breathing, forty years of age, used the shower bath (thermal). During the fourth bath she saw on the wetted part of the body, especially the lower limbs, a number of electric sparks. The darker the room, the more perceptible were the sparks; they were perceptible either near or at a distance from the light. After the patient had taken a few more baths, the sparks decreased, and the illness disappeared." Alibert says—"I have attended a patient affected with paraplegia (paralysis of the lower part of the body), who was always better when he took the water during a storm. He always had the bath when he heard the thunder. No doubt electricity acts on mineral waters."

There is another possibility. Until lately no positive proof was afforded of the existence in the atmosphere of subtile and ethereal principles of a miasmatic character, however much their existence might be suspected. All attempts to test chemically the purity of the atmosphere were confined to ascertaining the amount of its carbonic acid, azote, and oxygen. We now know that there is another principle, especially developed by electrical action during thunderstorms, and various atmospherical changes, and whose presence on good grounds is believed to be essentially connected with health—ozone.* Thus, during the cholera of 1854, there was a marked deficiency of ozone at all the metropolitan stations where its presence was noted, compared with corresponding stations in the country; and this deficiency was greatest towards the close of August and beginning of September, precisely when the cholera was at its worst. Excess of ozone, again, is believed to be connected with the prevalence of a different class of diseases. If subtile principles of this kind exist in air, why not in water may something of the kind occasionally be developed? At any rate, in the present state of our knowledge, we are not entitled to deny the superior power of thermal waters over ordinary baths, simply because their operation cannot be explained by their heat alone.

---

* Lersch—*Mineralquellenlehre.*

## CLASSIFICATION OF MINERAL WATERS ACCORDING TO THEIR CHIEF CONSTITUENTS AND MOST IMPORTANT CHARACTERS.

1. The Gaseous waters, or those from which there escape bubbles of gas, are almost entirely the waters containing carbonic acid; for sulphuretted hydrogen and other gases rarely exist in sufficient quantity to escape in this manner. Along with carbonic acid different salts may exist in such waters, as alkaline carbonates, carbonate of lime, and carbonate of iron, all additions of importance, and sometimes, nay, often, other classes of salts, as chlorides and sulphates,

---

* Ozone is believed to be oxygen in a more highly developed electric state. The peculiar smell when large electric sparks are passed through the air, as from the hydro-electric machine, or when lightning has struck objects near observers, is supposed to be due to ozone.

are mixed with the carbonates, or are alone, which is rare. Seltzer water contains one and a half times its bulk of carbonic acid. Its salts are chlorides and carbonates.

Some of the mineral waters charged with carbonic acid disengage it in sufficient quantity to cause it to produce a distinct sensation of a sort of prickling at the nostril, and a sharp sensation in the mouth when swallowed; and mixed with wine these carbonic acid springs have some of the qualities of champagne. When some of these, containing lime or iron in solution, are exposed to the air, the lime or iron is gradually precipitated as the carbonic acid escapes. The water then becomes insipid. All these waters do not contain the carbonic acid with an equal chemical or mechanical power; some lose the gas more quickly than others. Artificial Seltzer water, which is perhaps more agreeable at the moment than the natural water, as drunk imported, loses its carbonic acid much more quickly. It must not be forgotten, that carbonic acid gas itself in solution has very active properties as a stimulant, and perhaps even as an intoxicating agent.

2. The Sulphurous waters form a very important class. In them the sulphur exists in two forms, viz., as a sulphuret of an alkali or earth, and in the form of sulphuretted hydrogen gas, or free hydro-sulphuric acid. The importance of the existence of sulphur in the former state has only been recognised of late years. As far as I am aware, the existence of sulphur in this form in a mineral water in Great Britain has not been determined until lately, except in one instance, viz., at Gilsland. Experimenting upon this water, which had been long ago analysed by my venerable friend Dr. Clanny, in 1843, I found that, after heating it thoroughly, it still gave a black or brownish-black precipitate with acetate of lead, whence I concluded that it contained an alkaline sulphuret—sulphuret of sodium. I was then ignorant of the fact that very great importance had been attached to the existence of this principle in the mineral waters of the Pyrenees especially.

Besides the sulphurets, and sulphuretted hydrogen, the sulphur waters contain also sulphates, chlorides, nitric acid, iron, sometimes the principle called *sulfuraire*, and other bodies. Sulphur waters, when drawn, are clear, but generally become somewhat milky on standing: they have often a sweetish taste. Very often they have a greenish or bluish colour. When fresh their odour is rather that of boiled eggs; after a time it becomes more like that of rotten eggs. The smell is no test of the strength of the water, since that depends not merely upon the quantity of sulphuretted hydrogen gas, whose escape occasions the smell, but upon the amount of sulphuret in solution. However, the sulphuret is gradually decomposed by the action of the air,* and the sulphuretted hydrogen evolved, so that waters containing it, after a time, disengage the gas, and produce the smell. In Harrowgate water there is free sulphuretted hydrogen and sulphuret. Formerly it was believed that to the sulphuretted hydrogen alone was due the activity of sulphuretted waters; those alkaline and earthy sulphurets were never thought of; but it is now known that the greater number of these waters owe their properties, not to free sulphuretted hydrogen, but to the sulphurets. Many of these sulphuretted waters yield sulphuretted hydrogen when heated.

In general, the thermal springs contain the sulphuret of sodium, and the cold springs the sulphuret of calcium; and the quantity of sulphur present in mineral waters is mostly very feeble. The quantity of free sulphuretted hydrogen in Harrowgate water, old Sulphur Well, estimated by former observers at 16 to 17 cubic inches of gas to the gallon of water, has been reduced by the recent more exact researches of Dr. Hoffmann to about a fourth of that quantity. He finds a sulphuret instead. It may be inferred from what has been said that a water may be *very* sulphurous without having much smell of the gas.

---

* The carbonic acid of the air acts upon the alkali, forms a carbonate, and liberates sulphuretted hydrogen. A sulphuret of potassium and a hydrosulphate of potassa are the same thing; the distinction being the same as between chloride of sodium and hydrochlorate or muriate of soda.

3. Alkaline.—These generally contain the carbonate of soda, sometimes the carbonate of lime, or magnesia, and very often other salts. They are generally found near volcanic rocks, basalts, schists, porphyries, etc.; in Auvergne, near the Rhine, or in Bohemia. They are often united with chlorides or sulphates. They may contain iron; in that case held in solution by excess of carbonic acid. In general, the quantity of solids which these waters contain is small.

In some springs the quantity of lime held in solution by the excess of carbonic acid is so great, that objects placed in the stream are rapidly encrusted as the excess of carbonic acid goes off. The petrifying springs are generally of this character. The properties of these alterative springs containing carbonate of soda are so very important, and the results so well verified, that especial consideration will be given to them in this work.*

4. The Saline springs should be divided into sulphated and chloruretted.

The sulphated are those which contain sulphates as their chief ingredients. According to a somewhat fantastic German arrangement they have been called *Pikropekgæ*, or bitter springs. They are characterized generally by the predominance of sulphate of magnesia, often associated with carbonates. Bilin, along with the sulphates, contains above 20 grains of carbonate of soda to the pint. Pullna may be taken as a specimen of these springs, containing in a pint nearly 300 grains of solids, of which a great portion are sulphate of magnesia and soda; powerful purging agents, of which common experience testifies.

---

* Superficial sulphuretted waters may be derived from the action of iron pyrites and water, when the iron is oxydated and the sulphur combines with the hydrogen of the water, or from the decomposition of sulphates in water by organic matter, carbonic acid, carburetted hydrogen and sulphuretted hydrogen being the products. In this way Daniell accounted for the poisonous character of the atmosphere on the coast of Africa, supposing it to be due to the decomposition of sulphates in sea water by vast quantities of organic matters brought down by the rivers. If any water containing much sulphuretted hydrogen were more likely than another to be derived from organic matter, Harrowgate, from its origin, or supposed origin, is the one (in a great part); but 1st, it contains no sulphates; and 2nd, it is remarkably free of organic matter.

These springs may be divided into the following classes:—

(1.) The sulphates of soda. (Glauber salts.)

(2.) The sulphates of magnesia. (Epsom salts.)

(3.) The sulphates of lime. Bath and other thermal springs.

As to the power of these last we are a good deal in the dark, but there are reasons for believing it to be very considerable.

(4.) There are springs containing very large quantities sometimes of sulphate of iron, as Sandrock in the Isle of Wight; in fact, quantities too large to be given medicinally in an undiluted form. The sulphated springs are generally of a somewhat bitter taste, and cold. Cheltenham and Leamington are specimens of these springs in England, although in both cases the sulphates are associated with muriates.

The muriated springs, or those in which chlorides form a principal constituent, are very numerous; often associated with other kinds of springs. Harrowgate is an example of an almost pure muriated water, with sulphuretted hydrogen as the most active ingredient.

Of the power of the muriates or chlorides as exciting and depurating agents, there can be no doubt. The part that common salt plays in digestion is well known, and also the consequences of its deprivation. Along with common salt in muriated springs, quantities of the iodides and bromides of the same bases are almost certainly associated. To the presence of these, great and exaggerated importance has been attached. The bromides and iodides are a little more active than the chlorides in the case of such salts as those of potassa and soda, less so in regard to the compounds with metals, following in this respect strictly the chemical law of analogies.

5. The Ferruginous Springs.—Here the principle is generally the carbonate of iron, held in solution by excess of carbonic acid. This rapidly escapes when the water is exposed to the air. Hence the stones and other objects near a chalybeate spring are generally stained by it. Hitherto

the carbonate and sulphate are almost the only salts of iron found in such springs. The muriate has been very rarely found. I have detected it in the excellent and little known chalybeate of Lorton, near Keswick.

Note.—Arsenic.—If the table given by M. Herpin be correct, the quantity of arsenic in some waters is not so insignificant. Thus 1000 litres of the Hôpital at Vichy gave 0·125 of a gramme; and that of another water 0·5 of a gramme—a perfectly appreciable quantity. It does not follow, however, that a poison is injurious in small quantity. Thus I have prescribed the 50th of a grain of strychnia three times a day for months with great benefit. I remember once being consulted by a brewer who had a recipe for bittering porter, in which copperas and cocculus entered. Having been the first to bring before the profession the singular properties of picrotoxin, the active principle of cocculus indicus, I might be supposed capable of giving an opinion upon the question he put to me as to the danger of using his recipe. Picrotoxin, the active principle of the seeds, is perhaps the most horrible poison for its effects in existence; but it is not a very active poison. Its symptoms are very singular, causing animals to walk or run backwards, evidently against their wish. I told him that in the quantities ordered the recipe would do no harm. The uproar about strychnia in bitter beer will be remembered. I question whether beer might not be bittered with strychnia, especially as an assistant to other bitters. It has almost incredible powers of bittering.

# CHAPTER III.

Medicinal Action of Mineral Waters.—Hot and Cold Bathing.—The Sea.—Sea Air.—External Applications of Gas.—Mud Baths.—Properties of the Different Classes of Waters.—Selection of a Mineral Water.—Climate, Diet, and Regimen.

The first action of water taken into the system in larger quantity than usual is to wash and humidify the organs and tissues, and favour the changes which carry out of the body vitiated and effete principles. Independent of its foreign constituents, water alone tends to depurate the system, and especially to increase the action of the skin and kidneys.* When we consider the important part which water plays in nature; that animals contain six-sevenths or seven-eighths of it, and some vegetables 90 per cent.; that it is everywhere in the frame, and carries its constituents everywhere, we cannot be disposed to doubt its power to effect great results in the system. But although water alone has this power, an important distinction must be drawn between the action of mere water and the more potent effects produced by it when impregnated with medicinal agents. Ordinary water is *food* as well as drink, to speak somewhat paradoxically; it carries the salts, which are constituents of the body, just as much as is flesh. Lime, soda, iron, muriatic acid, etc., are just as essential components of our frames as what are generally understood by organic substances. Dr. Lambe, of Leamington, many years ago propounded the singular theory that all the ills that mortality falls a prey to are produced by the salts in spring water, and confined himself and family to distilled water. Distilled water, indeed, will support life, as is seen on board steamers at sea, and rain water is used in some countries: but they are not palatable. A man requires about two and a-half pints of water daily. When water is so highly charged with mineral principles as to have its sensible qualities altered, it exerts the powers of a medicine; and in what respect does medicine differ from food? Mainly in this—food is amenable to the laws of the organization, but medicine forces the organism to obey *its* laws, and is, therefore, of the nature of poison. The beneficial effect of those medicines which remove effete principles from the body is shown by the increase of certain principles in the urine and probably the perspiration. The chief of these are urea and uric acid. These represent the worn-out materials of the frame, and are the ultimate results of their transformation.

---

* It is now proved, by the researches of Böcker, that water increases the activity of the metamorphosis of the tissues when taken in larger quantity than usual, and the amount of solid matter excreted.

Many of the saline and sulphurous waters act in great part by stimulating the secretions and excretions. Exercise materially favours the elimination of morbid materials—of excess of carbon by perspiration, of phosphoric, uric, lactic, acetic acids by the skin and kidneys—which, if they remain in the system, are fertile causes of disease, as of gout, rheumatism, gravel, scrofula, in particular. Hygienic causes combine with the influence of change of scene, and by a fortunate circumstance most mineral waters are seated in eligible localities. Many medical men attribute the good effects produced in fact to these causes rather than to the waters themselves. Into this question it is not necessary to enter too narrowly. In the use of mineral waters we have in general an agreeable and often a potent remedy administered in a way calculated to produce the best effects.*

---

* Sea-water will dissolve less atmospheric air than ordinary water. The researches of MM. Morren and Leurz have proved that in sea-water, on the coasts of the Channel, the quantity of air, which varies in ordinary fresh waters from $\frac{1}{30}$th to $\frac{1}{20}$th of its bulk, would vary from $\frac{1}{45}$ to $\frac{1}{30}$th; and that whilst the air of running waters contains, in ordinary circumstances, 32 per cent. of oxygen and 2 to 4 per cent. of carbonic acid, the water of the sea in a constantly clear sky, dissolves habitually 9 to 10 per cent. of car-

The practice of hot and cold bathing has never been much systematized in the cure of disease except in the indiscriminate hands of the hydropathists, who have shown what a powerful remedy they wield. There cannot be a doubt but that in many systems, where the powers of life are yet unbroken, the effect of hydropathy is often to relieve internally-congested organs, to procure the removal or relief of rheumatic and gouty diseases, and to benefit many local nervous affections. But the question is, whether these effects cannot be produced more safely and pleasantly by other means; by sea-bathing, shower-baths, hot baths, &c.

1. It is impossible to exaggerate the benefit of sea-bathing in constitutions which still retain vigour. The effect of the bath is enhanced by the air at the sea-side. This air in many places contains more oxygen and more ozone. It also contains minute quantities of chlorine, bromine, and iodine. It is to these ingredients that sea air in all probability owes its beneficial effects. The following minute account of the

bonic acid and 33 per cent. of oxygen, and that, after a succession of fine days, the quantity of oxygen dissolved goes on increasing, and may attain 39 per cent.; the opposite limit, corresponding to the most sombre day, being 31. Even more oxygen is dissolved by pools where there is much marine vegetation. When sea-water is rich in oxygen dissolved, this gas is given out into the atmosphere, whence it results that the air placed above pools by the sea-side, where there is much vegetation, may contain in calm weather, and under propitious circumstances of light, a much greater quantity of oxygen than what is found habitually in the atmosphere. (*Annuaire des Eaux de la France.* Paris, 1857.) The sea is an abundant source of ozone. (*L'Ozone.* Par H. Scoutetten. Paris, 1856.)

With regard to the existence of chlorine and its associated elements in sea air, an Italian experimentalist endeavoured to ascertain this point by bringing a balloon full of ice in the air, and collecting and testing the condensed water. The writer some years ago forced a large quantity of air by the sea-side, the wind not blowing from the sea, through a solution of nitrate of silver, and had no difficulty in obtaining proof of the presence of chlorine, with which doubtless iodine and bromine are associated. The presence of these principles in sea air is sufficient to account for its bracing effects, and the general ruddy appearance of all who follow marine pursuits. The smell of the sea has very much of the odour of these principles. It is decidedly stronger where there is much sea-weed, and where the decaying and growth of these marine plants is going on, which is in accordance with what we might expect. These tolerably positive results with regard to sea air are interesting, because the beginning of a new field of investigation.

symptoms observed in cold bathing is from the work of Lersch:—" Begin, who took nine cold baths from the 12th to the 20th of October, 1819, at eight o'clock in the morning, at a temperature of from 34·5° to 45°, thus describes the sensations produced:—' At the moment when one plunges into the water one feels a severe shock in the larger cavities, particularly of the chest, respiration becomes difficult, interrupted, and quick, appearing as if it would momentarily cease. The skin becomes pale, the pulse contracted, small, as if it shrunk inwards, and hard. All the tissues become stiff. One does not shiver, but is seized with a universal cramp, which almost prevents one from moving. After this almost intolerably painful condition, which lasts at most between two and thre minutes, follows rest, one's chest expands, motion becomes free and easy, warmth spreads itself over the whole surface of the body, muscular action becomes lively, easy, and sure. One feels as if the sheaths of the muscles pressed them more firmly and strongly. Shortly the whole surface of one's body becomes of a lively red, and a very agreeable feeling of warmth spreads itself over the whole skin, one feels as if swimming in a stream at a temperature of from 100° to 113°, the water seems more buoyant, the pulse is full, powerful, strong, and regular. Few sensations are so delicious as those one feels at this moment. All the springs of the living machine are more flexible, stronger, and firmer than they were before. A sensation of ease pervades one's limbs, which move in the surrounding water with facility. After from fifteen to twenty minutes this pleasing feeling gradually diminishes, and is followed by a sensation of chill; and if one did not get quickly out of the water, one would be seized with shivering, followed by universal trembling, and motion would become so difficult, that many would be in danger of being drowned. One should not remain long enough in the water to allow the reaction to cease." He then says that the skin on emerging from such a cold bath is little sensible, and that severe friction may be used without much sensation. Such are the sensations experienced when a cold bath agrees with the bather. When it does not, the first sensation of chill is more permanent, there is often determination of blood to the head, and even positive pain, frequently severe cramps of the limbs. After leaving the bath, the pulse remains shrunk and weak, the extremities cold. In short, no reaction takes place.*

After sea-bathing, the bather should, if possible, take exercise by walking or riding on the beach, or by rowing. He may add to the treatment by drinking some sea-water, about a tumbler full. It is tonic and aperient. The best time for such a bath for the invalid is in the forenoon, between breakfast and dinner. Few sensations can be more delicious than those which the bather experiences on leaving the sea after a bath and swim in the brine, and proceeding to enjoy active exertion. Certain iron springs are even still more tonic than sea-water, used as baths, such as Schwalbach, in Nassau, the effect of which Sir Francis Head compares to that of a tan-pit, but he experienced the good effects of the water in strengthening the skin. Such a water is Sandrock, in the Isle of Wight. In the same category may be mentioned the mud baths, for which Franzensbad is particularly celebrated. The mud used is a species of bog earth, whose base is lime and alumina, with salts of soda and iron, ulmic acid, and various resinous and organic principles; heated with steam, and diluted with mineral water, it forms a kind of pasty stuff, like a soft poultice of bread crumbs steeped in ink. However, in cases of debility, green sickness, in gouty and rheumatic affections, in paralysis, sciatica, old wounds, and in some skin diseases, very excellent effects have been obtained from this somewhat strange application. It appears to strengthen the skin, and to excite its action. The idea of using this remedy is not altogether new.† At least, towards the close of last century, a certain Dr. Graham went about exhibiting earth baths. He was accompanied by a female, whom he styled the "Goddess of Health," and who is believed to have been, at least at one time, the afterwards celebrated Lady Hamilton. The writer has conversed with one who recollects to have seen the Doctor and his Goddess buried up to the neck, he with his powdered head and pig-tail just above the ground.

---

* *Einleitung in die Mineralquellenlehre*, s. 489, et seq.

† It was known to the ancients.

Every kind of douche has been invented of late years—ascending douches, in cases of female disease; douches of carbonic acid gas, from those baths which yield it in great abundance. Apparatus have been invented for subjecting large portions of the body, or the whole body, and every part of the head, to the operation of the gas, and for directing a stream of it to any particular part, say, for instance, the ear in cases of deafness. The advantages of gases applied externally have not yet been fully brought out. Many years ago, the late Mr. Wallis, of Dublin, showed the great benefit derivable from chlorine applied externally in liver diseases of old standing. The plan of Mr. Wallis was to enclose the body all but the head in a case which was filled with chlorine. The result was to produce intense heat of skin, attended with a prickling eruption, followed by profuse perspiration. It is strange that a method of treatment which promised such beneficial results has been abandoned, except in the instance of mineral waters, used almost solely in Germany, where carbonic acid gas is employed extensively as an external application, and, when diluted, is inhaled.

The first fact that drew attention to this method of cure was in the case of the late Dr. Struve, so well known as a manufacturer of artificial mineral waters. Dr. Struve was taking the waters at Marienbad for a very painful lymphatic affection of the thigh and left leg. For several years he had been unable to walk without the assistance of crutches, the glands and lymphatic vessels of the leg being hard and inflamed. He had, besides, enlargement of the liver and piles.

He formed the idea of exposing the diseased leg to the action of a current of carbonic acid, disengaged by one of the Marienbad springs, and which formed a layer a foot thick upon the surface of the fluid. Leaning on his stick, and supported by his servant, he reached the spring with much difficulty, and, seated on the edge of the basin, he let his leg hang in the current of gas. He experienced at first an itching and agreeable heat, which went on increasing until it produced a free perspiration of the affected leg. When he withdrew his foot from the gas-bath he was surprised at feeling no more pain, and even being able to walk without his crutches. After continuing the use of the bath for some time, he left Marienbad cured. Since that time he long enjoyed excellent health, without relapse or renewal of his pain.

There are now apparatus for the use of the gas at several of the German spas, as we shall see. It is used either pure or mixed with air, sulphuretted hydrogen, or other gases, dry or moist, or mixed with other vapours from mineral waters. Even common public baths of carbonic acid are taken in a basin; for the gas readily penetrates the clothes. The more delicate the patient, the greater the susceptibility to the effects of the gas. The first sensation is one of agreeable heat; then a prickling and itching, and a feeling of intense heat. Old pains, especially those from wounds, return; the skin becomes red, and an abundant *acid* perspiration follows, while the action of the kidneys is increased. The sensation of heat, and perspiration continue for several hours after leaving the bath. Along with these external symptoms, the pulse becomes more rapid, the heart beats more strongly, the heat becomes burning, there is headache and difficulty of breathing; and, if the bath were continued too long, it might produce a state of stupor, with black blood, and finally asphyxia.

This is, then, a powerful means of treatment. It acts most powerfully in all affections where suppressed perspiration or want of action of the skin is the cause, and hence, as may be supposed, relieves internal congestions. In suppressed piles—to which, by-the-bye, the Germans attribute almost all diseases under the sun—in accelerating the female functions and in sterility, these baths have a great reputation.

Douches of it are used in weakness of sight, loss of hearing, and debility of particular organs. Miners employed in the Cordilleras, and exposed much to carbonic acid, according to M. Boussingault, after a time are apt to have weak sight. Doubtless in this case, as in others, over-stimulation of the organ, in the first instance, is followed by debility.

Carbonic acid gas, besides its other properties, is antiseptic, hence it ameliorates fetid purulent discharges.

Some excellent cases of its utility, besides that of Dr. Struve, are on record. Thus, a person subject to such excessive coldness and stiffness of the hands that he could not dress himself until they had been rubbed for an hour in the morning, was completely cured. A singer of Vienna, who had lost his voice in consequence of an inflammation of the respiratory organs, was completely cured by inhaling the gas in, of course, a very dilute form.

At many thermal springs the vapours are conducted into apartments which serve as sudatories; and thus, at the same time, the gases are inhaled.

It is a matter of surprise that so little use has been made of the introduction of remedies by inhalation, of which the effects of chloroform, and other anæsthetic agents, show the great power. Galen makes mention of a British physician as famous for this practice.* Both in this respect, and in the external application of vapours, a great field is open for investigation. It was formerly the practice to smoke cinnabar when an early effect of mercury was desired.

The absorption of many of the principles of mineral waters by the medium of baths is a fact proved especially in the case of sulphuretted hydrogen and carbonate of soda. A very few baths at Vichy suffice to render the urine alkaline.†

---

* The Roman soldiers smoked! Pipes, like our tobacco-pipes, but smaller, are found near almost all the stations. What did they smoke? Was it hemp?

† A very excellent alkaline bath may be made by taking a pound of the common carbonate of soda of the dry-salter, and putting it, coarsely pounded, into a hot bath. If sulphates of lime and magnesia be present, there will be an abundant precipitation, which will cause the water to become milky and much softer. Such a bath is exceedingly cleansing.

Sir J. Forbes, in speaking of the baths at Leuk, in the Valais, and the long time that the patients stay in the water, four or five hours, remarks upon the power of hot water so applied. Immersion, he remarks, in a fluid exceeding the temperature of the human body for so long a period, *must* produce some important change in the organism. Of what a nature that is we may see from the case of the Swiss peasant, already quoted. It excites powerfully the skin, diverts the fluids from the central organs, and, in short, produces a complete revulsion, while it greatly stimulates the whole system of the glands. If, along with this, large quantities of hot water are introduced, obstructions are broken down, and the whole machinery of life put into fresh motion. The composition of Bath water, as Sir J. Forbes points out, is very similar to that of Leuk.*

## MEDICINAL PROPERTIES OF THE DIFFERENT CLASSES OF WATERS.

1. Of Carbonated Waters, or those which contain an unusual quantity of carbonic acid.—The waters containing carbonic acid in excess may be regarded as almost pure stimulants. The effect of the gas is to exalt the properties of the other substances in the water, for instance, the iron, the alkaline carbonates, or the salts, and to render the water more grateful than it would otherwise be.

2. Sulphur Waters.—It has been said that the sulphur occurs in these waters in two forms, viz., the sulphuret of sodium, and hydrosulphuric acid or sulphuretted hydrogen. Under these two forms its action is not the same. When the gas is free, and disengaged in abundance, it may operate

---

* The presence of sulphate of lime in several waters celebrated for their beneficial effects in calculous and rheumatic complaints, as those referred to, is a fact worthy of note. Sulphate of lime is generally considered inert, but in solution, in this way, it may, perhaps, prove to be in reality anything but an indifferent substance. At any rate, it is a fact that it exists in many thermal springs which resemble each other in their effects, and in their reputation for curing the same classes of diseases.

both by the lungs, by the skin if used in baths, and by the stomach. The sulphuretted waters especially excite the stomach, the skin, and the kidneys; they rouse the appetite, excite the pulse, and sometimes produce a kind of feverish restlessness, with headache. This state of excitement is frequently followed by copious perspiration or excessive action on the kidneys. Of all the waters, the sulphuretted are perhaps those which tend most—especially when the gas exists in large quantity in a water highly charged with salts—to produce what medical men call an alterative effect, that is to say, to change the state of the system; and this they do by this very action on the skin and kidneys. In diseases of the abdominal organs many sulphur waters have an especial reputation; they excite the functions of the spleen and the liver, and are somewhat laxative; also the secretion of the intestines, of the organs of respiration, and the absorbent vessels. In the form of baths they are found very beneficial in old diseases of the skin, and often assist in dissipating tumours. In chronic rheumatism, gouty affections, diseases of joints, etc., they are of great and acknowledged utility.

Their absorption is proved by the effect which they produce on the preparations of lead and mercury. It has been remarked that minerals used along with sulphur waters do not produce salivation; and patients who, after being salivated, make use of the sulphur waters, soon recover of the salivation. It has also been observed that patients support the arsenical preparations better when using a sulphurous water.

According to M. Astrié, the sulphuret of sodium and other preparations of sulphur found* in sulphur waters, or which may be formed in the body in consequence of their action, dissolve the insoluble compounds which albuminous matters form with mineral compounds, and which may be supposed to be a great obstacle to the due performance of the functions of the body. At the same time, besides their presumed and probable chemical effect, the sulphur waters will act vitally by stimulating the secreting and excreting organs, and thus getting rid of the mercury which has been introduced into the system. Hence, in all the class of pseudo-skin affections produced by the abuse of mercury, this class of waters is of very great benefit. In fact, taking into account the hygienic advantages of spas, sulphur waters appear to be the very kind of remedies most appropriate for such diseases; and if thermal so much the better, both on account of their use as baths, and the power of thermal waters to penetrate the tissues. The sulphur waters which contain the sulphuret of sodium seem to be very well supported by the stomach, especially if they contain alkaline carbonates as well. If they contain chlorides, their action is more directed to the glandular system; and in scrofulous tumours, or enlargements of the abdominal viscera, their use is especially indicated; if they contain sulphates, they are more apt to act as purgatives; when combined with iron, their use is more especially as tonics. The discovery of the existence of the sulphur of waters partly in the form of sulphuret, may be turned to account in several ways:—first, those waters which contain most sulphur in that form are fittest for baths; secondly, they are fittest for transportation; thirdly, it is a question whether they are not more powerful when drunk; fourthly, for inhalation those which contain the gas free are fittest.

---

* The hyposulphite and sulphite of soda. I believe that a great part of the effects of chemical substances in the system is due to a series of combinations and decompositions, whereby a series of molecular changes is brought about. Thus, suppose that common salt is decomposed in the stomach, that its muriatic acid takes part in the first part of the process of digestion, while its soda goes to the bile, and afterwards into the blood, but neither muriatic acid nor soda can remain free, they must exercise their chemical

3. Alkaline Waters contain generally the carbonate of soda with carbonic acid, as has been said, and act chiefly by

---

energies. Hence, a constant series of changes. If free iodine is administered by the stomach, it is found in the urine in combination. This is what takes place in chemical action out of the body, where there is a constant tendency to change the existing states of bodies. Many examples might be given.

the alkali. The alkalies have a powerful action on the blood, opposing its coagulation; and the caustic alkalies even dissolve the blood-globules. The power of the alkaline carbonates, although less than that of the caustic alkalies, does not admit of question. The excessive fluidity of the blood in scurvy has been attributed to the decomposition of common salt and the overloading the blood with soda. Alkaline carbonates are easily decomposed, and may thus give rise to numerous molecular changes. They readily unite with acids, acetic, muriatic, etc.; hence one of their first uses is to destroy acidity in the stomach. They are, besides this chemical power, possessed of a vital action on the membranes of the digestive organs, when these are in an irritable state, acting as calmatives; they besides supply the alkali necessary for the bile, and are supposed to favour the formation of that important secretion when deficient. In the whole class of gouty affections they are supposed, first, to prevent that peculiar state of the secretions which, connected with morbid acidity, gives rise to the formation of calculi; secondly, to fluidify the blood, often loaded with excess of solids and of the fibrinous principle,* and to act as a solvent upon the lithic acid, itself the basis of most calculous and gravel formations; and thirdly, by this action on the excretions, to favour the expulsion of morbific matter from the system.

---

* The state of the blood in rheumatic and scrofulous affections, and, so far as is known, in cancer, throws great light on the pathology of these diseases, and their relation to ordinary inflammation. In rheumatism generally (the plethoric kind) there is excess of blood-globules and solids of the serum, with excess of fibrin. In scrofula excess of solids of the serum (unworked-up blood-plasma, or nutritive matter of the blood), with *diminution* of the number of blood-globules, while the fibrin remains of about the normal standard. Finally, in cancer, while the blood otherwise bears some relation to scrofula, according to the few analyses yet published, there is enormous development of fibro-plastic organizable material. In ordinary inflammation the constitution of the blood, before it is changed by the inflammatory action itself, is more normal. Hence, in a scrofulous person the causes which would determine inflammation lead to the effusion of matter incapable, from want of organizable power, of passing into the higher cell-forms, and which remains a source of irritation where it is deposited. This and the continuance of the scrofulous constitution account generally for the phenomena of scrofulous inflammation. In rheumatic-gouty affections the greater strength of the constitution carries the defect in the state of the blood a further stage. It is shown in excess of uric acid, transformed albumen and fibrin. In cancer the formation is endowed with a parasitic power of organization, and preys upon the exhausted system. The microscope bears out this.

These alkaline waters, then, have a calmative action upon the nervous system, and allay local pain; they also exercise the same soothing influence in many bronchitic affections. They increase greatly the quantity of the urinary secretion, and their great and especial function is in acting in this way on the solution and disintegration of gravel and urinary concretions; they are but slightly purgative. In all these actions, the compound which is the most active is the carbonate of soda; those of lime and magnesia are less so, although by no means devoid of energy. For instance, lime and lime-water have been much employed formerly in stone.

In many scrofulous affections, and weak constitutions in young people, there is excess of acid in the stomach. Here the employment of alkaline waters will be beneficial, especially if the water contains also iron. In chronic affections of the skin, where there is much nervous sensibility. Finally, not to enumerate affections in which the action of these waters is more obscure, there are two most formidable diseases in which they have been considered of value,—Bright's disease of the kidney and diabetes. Bright's disease is brought about by repeated congestions and inflammations of the secreting part of the kidney, the results of intemperance, great changes of temperature, or frequent exposure to cold,—causes which throw a sudden excess of work upon the kidneys; in the end albumen is thrown out, so as to obliterate and choke up many of the ultimate cells and ducts in which the urinary secretion is formed and eliminated. The consequence is, that while the kidneys are unable to perform their proper function of separating the excretory principles from the blood, they allow the serum or albuminous part of the blood to pass, and thus the unfortunate patient is drained of the materials of nutrition, while at the same time the blood is poisoned. By soothing the action of the kidneys, and probably rendering the blood less acrid, alkaline waters are useful in this disease; and perhaps it is in the same way that they are useful in diabetes.

The waters of Vichy are the pre-eminently alkaline waters.

Those of Ems have been supposed to be efficacious in cases of tendency to pulmonary consumption.

The excessive use of alkaline waters may bring about a state of the blood characterized by too great fluidity, as in scurvy.

4. Saline Waters.—The chloruretted waters act in the first place as stimulants to digestion. Common salt itself is eminently tonic, and, according to most physiologists, plays a direct and important part in digestion. It is believed, as has been already said, to furnish the principal constituent of the gastric juice—muriatic acid; the other being a substance named pepsin, a species of animal ferment which has been used in a separate form in medicine.*

There is some doubt about the acid of the gastric juice; but muriatic acid, with the aid of a gentle heat, will dissolve animal matters even out of the stomach, and is a most excellent and powerful tonic besides. The chlorides are not so purgative as the sulphates, although they do exercise an aperient action. While the sulphates act rather upon the abdominal viscera and as purgatives, the action of the chlorides is more directed on the glandular system. They are especially useful in scrofulous affections, when combined with iron; and in the same way in bringing on changes with young females. No class of waters is more beneficially and constantly employed in the various forms in which water may be resorted to; they act as powerful tonics, and as stimulants to the skin, especially in the form of hot baths. The alleged importance of their association with iodine and bromine has been spoken of.

The sulphated waters owe their properties usually to the presence of the sulphates of soda and magnesia,* both purgatives in large quantity, and somewhat aperient even in small doses. By augmenting the secretions of the intestines, they relieve congestions of the abdominal organs, and also affections of the head; and thus, without possessing the direct powerful tonic action of the chlorides, they are indirectly favourers of digestion. They also have an evident tendency to subdue an irritable, almost inflammatory state of the organs, which they may effect directly, for, according to the experiments of Mr. Blake, some of them when introduced into the blood, especially the sulphate of magnesia, have a directly sedative and even depressing effect; they also render the blood more fluid, relax the muscular fibre, and act as diuretics. They also exert a marked action on the uterine system.

---

* According to Bidder and Schmidt, the gastric juice of a dog free from saliva contained 26·938 parts in the 1000, of which 17·227 were pepsin, and 3·050 muriatic acid; the remainder chiefly chlorides, with some phosphates. According to Schröder, in human gastric juice of a person on low diet, 5·596 were solid constituents: of which 3·195 were pepsin, and 1·2 muriatic acid: the rest chlorides.

Few waters are so much improved by the addition of carbonic acid as the sulphated; otherwise they are apt to lie heavy on the stomach. The thermal spas of the class are more excitant, and generally, in fact, much more active. Sulphated waters are mostly used in diseases of the liver and spleen, hæmorrhoids, gouty affections generally, in which the functions of the bowels are much disordered, habitual constipation, congestions of the head, palpitation, skin diseases, etc.

5. Chalybeate Waters.—It has been well remarked that iron is the great mineral tonic, as quinia is of the vegetable kingdom. "As true as steel,"† holds good in medicine. Iron is one of the constituent parts of the blood, and has been made by Liebig to play a principal part in respiration. He supposed that in the lungs the iron absorbed oxygen, and was made the means of carrying this principle in the red globules of the blood to all parts of the frame—that it gradually gave off its oxygen on its passage, and absorbed carbonic acid, passing into the state of a carbonate, which again was re-oxidised, receiving a fresh dose of oxygen, and

---

* Glauber and Epsom salts.

† The saying of an old Bath physician of the time of Charles II.

giving off its carbonic acid in the lungs, again to carry the oxygen absorbed to the system. In this way he accounted for the red colour of the arterial, and the dark colour of venous blood. Against this theory there are several objections:—1st, the red colour of the blood does not depend exclusively upon its iron, but upon an animal principle called hæmatosine, with which the iron is associated, and there is only about $\frac{1}{2000}$th part of iron in the blood, which is too little to account for the whole phenomena of the aeration of the blood from mere changes happening to the iron; but of the power of iron absorbed into the blood to increase the quantity of the red globules, which is the important practical part, there is no doubt. According to MM. Andral and Gavarret, and others, in one case, where the quantity of globules in the blood had fallen to 44·6 in the 1000 parts, it rose after some weeks of the employment of iron to 95·7.* Generally speaking, under the use of iron in cases of impoverishment of the blood, all the solids of the blood increase in weight, but especially the red particles. The effect of this in the countenances of the patients alone is too marked to be mistaken. Along with this, the appetite improves with the weight of the body, the pulse becomes stronger, and all the bodily functions increase in activity. The effect of this is particularly marked in girls affected with green sickness. In scrofulous disease, where the blood is especially deficient in blood globules—and this state is essentially connected with the nature of the disease—the chalybeate waters are, it is almost unnecessary to say, in high request. Also in many diseases of females, and in sterility, in nervous affections generally, and, finally, as general tonics. In these classes of disease the acidulated chalybeates should be used; but where there are abdominal obstructions, a combination with salines, the chlorides, or sulphates. Such combinations are very useful in preventing the tendency of blood to the head which the long-continued use of chalybeates is apt to occasion, or the injurious effects of very powerful chalybeates. Surely, however, Dr. Granville greatly exaggerates, when, in speaking of Sandrock spa, he says—"The taste of the water is in itself so intensely styptic, that to drink even a wineglassful at first, without being previously diluted, would require great resolution. To one liable to fulness of blood, such an experiment would be positively fatal."

---

* The ordinary quantity varies from 130 to 140; there are different estimates.

This tendency of chalybeate waters to congest the head is best prevented by attending to the state of the bowels. It exists most in carbonated waters, where the gas not merely increases the power of the iron, but has an effect of its own, and is actually used by the people near some of the principal carbonated spas to produce a species of intoxication. Liebig supposes that in wines it passes through the coats of the stomach, and gets into the blood by a cellular imbibition.

Before quitting this subject of the general effect of chalybeate waters, it may be mentioned that a German writer* has endeavoured to explain the alterative effects of sulphuretted hydrogen waters by their action on the iron of the blood corpuscles, decomposing these, and forming the sulphuret of iron which is excreted. This is the cause of the dark colour of the dejections when the sulphuretted hydrogen does not pass off by the kidneys, but remains with the other excreta. He supposes that those corpuscles which have lost their vitality will first fall a victim to the chemical action of the sulphuretted hydrogen.

## SELECTION OF A SPA.

In selecting a spa, the first point is to determine whether it be expedient to travel; and then, if not, to consider which of the English spas is most suitable. At the end of this work will be found a classified list of spas according to the diseases in which they are most likely to be useful, as in phthisis, consumption, and chest diseases;—Mont Dore, Ems, Eaux

---

* Dr. Heinrich.

Bonnes, Cauterets, etc., with the reasons for the choice. As some guide, a table is subjoined of the elevation of several of the principal watering-places, and the temperatures of some of the chief cities. For phthisical affections a low muggy atmosphere seems best; but to show the difficulty of arriving at a definite conclusion—and in no disease have more pains been taken to arrive at a conclusion on this subject than phthisis—I may mention that we have the most contradictory facts. Places have been long recommended as a residence for consumptive patients now recognised as unfit, such as Montpellier and Naples. Dr. Martinez, of Mexico, long ago wrote on the climate of Naples, and took for his motto the very boast of the Neapolitans—

"Vedi Napoli e poi muori,"

using it in a very different sense from the common one.

A very valuable work has just appeared, which gives some statistics of the results of the rejections among 100,000 conscripts, or rather youths liable to the conscription, during the last thirteen years, in all the Departments of France.* Now, some reliance can be placed upon such statistics. And the chest diseases are in the ratios of the greatest differences. It happens so far fortunately that those Departments where there are the most mineral waters cut a good figure. Thus, while in the Département du Nord the rejections are in the annual ratio of 1116, in the Pas du Calais 1030; and in some of the Southern Departments, as Bouches du Rhone, 510; Var, 477; Gard, 437; Corse, 541; Rhone, 627; Vaucluse, 494; in some of the Departments where mineral waters most abound, as Hautes Pyrénées, Basses Pyrénées, Vosges, Nièvre, Puy de Dôme, they were respectively 160, 115, 69, and 118. But what conclusion can we draw when we find the mortality so high in the two Northern Departments, and in the exposed Finisterre and Morbihan only 60·8 and 51?

---

* *Traité de Geographie et de Statistique Medicales et des Maladies Endemiques.* Par J. C. M. Boudin. Paris, 1857, t. 2. pp. 660-661.

The mortality in the British army from phthisis is less as the troops go to a colder or warmer climate. The probability is that nothing so much predisposes to consumption and all scrofulous diseases as civilization and its concomitant bad habits. The people of Britanny are rude as their climate.

There are great advantages in travelling; the effect of change of air and scene, fresh air and exercise, even change of diet, although that *in itself* may not always be an advantage; for it appears to me that, on the whole, no people live more naturally as regards diet than Englishmen in tolerable circumstances and of correct lives,—cases of gluttony, gourmandise, and excesses of all kinds set aside. Soup not loaded with gelatinous or fatty matter like turtle, but simple, like mutton broth, or Julienne, or vermicelli, or fish, the most digestible of all food, with the plain roast or boiled, and perhaps a little game, or light pudding or fruit pie afterwards, a glass of beer, or a glass or two of light wine, a few glasses of port or claret with dessert, appear to the writer, at least, the perfection of a meal. It is true he is not a "budge doctor of the stoic fur;" and for luxury, a dish of trout fresh from the stream, with grouse broiled on the gridiron, served up with mushrooms, after a hard day's fishing or shooting. With invalids, and especially people afflicted with organic disease, the case is different. It may be necessary to put a man afflicted with diabetes on meat and macaroni, that he may eat nothing but nitrogenized food, or one with heart disease, or threatened with apoplexy from great plethora, on vegetable diet. Two solid meals daily, breakfast and dinner, are all that health requires: tea should be used solely, or as nearly so as possible, to digest dinner, and should follow it at an interval of two to three hours.

Of late years two sects have arisen, the vegetarians and teetotallers. Are there any real vegetarians? Do they not eat eggs? But they proceed on a principle not of humanity or of philanthropy (to apply such a term would be nonsense), but of pretended love for the brute creation. Yet, if their precepts were carried out, what would become of the herds of cattle and flocks of sheep which now adorn our pastures and our mountains? Why, the swine and the rabbits alone, as the phrase is, would soon eat us out of house and home. The fact is, we must kill them in self-defence; and if we kill them, why not eat them into the bargain? But it is out of the question to pursue such an argument.

Then the teetotallers. That some men can do without alcoholic stimulus is certain, and that they believe themselves the better for it; but the universal practice of mankind tells a different tale. We may say to them what was said of Cornaro, that surely the Almighty did not make the stomach of Louis Cornaro a model for all mankind. In the toils and struggles of life, with many or most men the necessity for occasional stimulus makes itself felt. There is one point connected with this matter which ought to be a lesson to theorizers, and above all to their believers; rather than theorizers, perhaps we should say framers of hasty and crude hypotheses. It is well known that Liebig divided articles of diet into those which go to support the solid nutriment of the body, as to constitute the muscles and the nerves; and those which go to form fat and be burned in the lungs, there to support animal heat. For this object he regarded the fat of the body as a mere magazine. Flesh and the gluten of flour, or those articles of food which contained nitrogen, belonged to the former class; starch, sugar, and *alcohol* in its various forms, to the latter. This specious doctrine met with ready reception in this country, as many German crudities do,* although a far more correct view existed in the admirable work of Dr. Prout, who divided articles of food into saccharine, oily, and albuminous.

Well, some recent researches of Böcker have shown not only that alcohol does not support combustion, but that it *retards it.* He has shown that it diminishes *all* the excretions, and that it diminishes the amount of carbonic acid exhaled from the lungs; he has also shown that the blood of a man who drank brandy daily, but not in excess, compared with that of an abstainer, was deficient in solid constituents, deficient in the fibrinous part of the blood; and that of the two kinds of globules which the blood contains—the red and the white—the latter were in comparative excess. Now these are believed to be the red corpuscles degenerated, and no longer capable of absorbing oxygen; on the other hand he ascertained another most important fact as regards the action of mineral waters, viz., that water drunk to excess increased the metamorphosis of the tissues, and the amount of substances carried out of the body; thus acting, though not to the same extent, exactly in the same mode as such a substance as iodine or colchicum would do; on the other hand, alcohol prevents or retards the waste of the body by diminishing excretion.

---

* I may allude more particularly to the protein doctrines of Mülder, whose views, brought before British scientific men by my friend, the late Professor Johnston, of Durham, met with almost instant acceptation, so that every one talked of protein. I remember expressing my doubts to a distinguished foreign professor on a visit to England, who said, "My friend, it is all one humbug!" The result has shown he was right. One fact has upset the whole.

Wine drunk to the extent of one or two bottles daily, produced little effect on the amount of the excretions, but a diminution in the amount of carbonic acid expired. Beer appeared not to produce vital changes, but to retain matter otherwise excreted. Sugar diminished the amount of carbon exhaled, and diminished some of the more important excretions.

Tea prevents loss of substance when the diet is insufficient, and when it is sufficient the body is more likely to gain weight under it than not. It diminishes the excretions.

Supposing these allegations to be correct, they explain many things,—they show that alcohol, however deleterious in excess, may have its use. The overtaxed sons of toil, whether mental or bodily labourers, especially if underfed, find that alcohol stops waste, and besides, by its anæsthetic properties, gives relief for a time in another way. They explain the fondness of the poorer labouring classes, who are not gin-drinkers, for tea; and one may almost infer that they show that wine is the better drink for the easier classes,—the easier classes labouring, however, intellectually—and beer, especially taking into account its actual amount of nutriment, for the labouring man, working in the sense of physical exertion.

White fish and white of egg are the most digestible articles of food, except perhaps milk; but they are the two which unite most easy digestion with nutriment, for a substance may be digestible, and not nutritive, and *vice versâ.* There are people who, by some strange peculiarity, cannot digest white fish and white of egg, and these are often found to be fond of fatty and other substances not easy of digestion to an ordinary stomach. Just so there are people to whom mutton is poison. I agree with Dr. A. Knox* when he says, "Most people will agree with M. Ude—no mean authority on the subject, albeit not a physician—that five-year-old juicy, dark-coloured, marbled mutton (not easily procurable, by the way, now-a-days) is not inferior to any other kind of meat."

At all spas there are some things to be especially avoided; eating, drinking, and smoking to excess by the men—the last perhaps altogether—and late hours and much dancing by the ladies. I say nothing of gambling and other abominations of the splendid German Cursaals, which Dr. Johnson calls "Curst Hells!"

Except moderation in diet, and regular exertion between meals, and light and agreeable mental recreation, there is nothing else which the invalid can do for himself, except, perhaps, attending to regularity in the performance of the proper functions, and following the rules of the place for taking the waters, generally the best, because founded on long experience. At all the principal watering-places there are experienced practitioners, respecting whom the only fear in general is that they may be too enthusiastic in praise of their spa, just perhaps as many medical men in general make too little use of mineral waters and the hygienic means connected with them. All that is natural enough.

---

* The Irish Watering Places: with an Analysis of the Principal Mineral Springs by Dr. R. Kane, &c. &c. By Alex. Knox, M.D. Dublin, 1845.

# PARTICULAR MINERAL WATERS.

---

## PART I.

### THE MINERAL WATERS OF ENGLAND.

ALTHOUGH mineral waters may be classified according to their chemical or medicinal properties, and it has even been attempted to arrange them according to the geological formations from which they arise—futile attempt, since the strata in which the springs appear are not in many instances those from which they have their real origin—yet, in practice, it will be found that the only feasible mode is to take them geographically, as the waters of England, France, Germany, and so forth. Dr. Granville classes the spas of England as those of the northern, midland, and southern divisions; but the space of this work does not require such a division. I shall arrange them in two sections—Section *A*, Northern spas, or those north of the Trent; and *B*, The Southern spas.

*A* will include, proceeding from the North, Gilsland, Shap, Shotley, Tynemouth, Croft, and Dinsdale, with a notice of Gainsborough and Butterby, Scarborough, Filey, Harrowgate, Thorpe Arch, New Malton, and Askerne, with the minor spas of Aldfield, Hovingham, Horley Green, Slaithwaite, and Ilkley; Buxton, and Matlock.

Some of these are of little moment in themselves; but may be made useful in illustrating the principles of mineral waters, showing, by way of contrast, what is and what is not a mineral water. Again, this section may be conveniently divided into chapters.

# SECTION A.

## MINERAL WATERS NORTH OF THE TRENT.

## CHAPTER IV.

Gilsland, the most northern of the English Spas; its romantic situation.—Old Border Castles.—The Roman Wall.—Sir Walter Scott.—Mumps Hall.—Dr. Granville.—Composition of Gilsland Spa; contains Sulphuret of Sodium; its properties.—Shap, Shotley, Tynemouth, Croft, and Dinsdale; doubts about the amount of Sulphuretted Hydrogen in them.—Action of Sulphuretted Hydrogen and Salts on Lead.—No fear of Lead Pipes and Mineral Waters.—Medicinal Properties of Croft and Dinsdale Waters.—Gainsborough.—Butterby.—Scarborough, the Queen of English Spas; its fine situation; unites the advantages of a Spa and Sea-bathing.—Analysis of Scarborough Waters; their Properties.—Dr. Witty.—Dr. Short on the Composition of Mineral Waters.—Resources of Scarborough.—Analysis of Filey Spring.—Advantages of English Bathing Places.—Specific Gravities of different Seas.—Analysis by Schweitzer.—Internal Use of Sea Water.

### GILSLAND,

The most northern of the English spas, is situated on the western banks of the river Irthing, near the line of separation between Northumberland and Cumberland, in the latter county, about three miles from the junction of the Irthing and Eden, and just where the barren moors of Bewcastle open upon the lovely and fertile valley of the Eden. The spa is easily reached either from Carlisle, from which it is distant about twenty miles, or from Newcastle, about forty, by means of the Newcastle and Carlisle Railway. The nearest station is Rose Hill, whence there is an omnibus to the hotel and spa, distant about a mile. The Newcastle and Carlisle Railway is unsurpassed in the kingdom for beautiful scenery, passing through the vales of the Tyne and Eden by the side of clear, sparkling streams, by old Border castles, every one of which has its history, and in many places in sight of the remains of the Roman Wall, which it intersects at Rose Hill. Gilsland, independent of its other merits as regards scenery and associations, derives interest from having been the spot where Sir Walter Scott first encountered his bride, the youthful and beautiful Miss Carpenter, then residing at the spa; and accordingly, in his works, he has repeatedly referred to the romantic banks of the Irthing; and the scenes and incidents of the "Bridal of Triermain," and of one of the most interesting portions of "Guy Mannering," are laid in the immediate vicinity of Gilsland.

Close to the station is Mumps Hall, where Brown first falls in with Meg Merrilies and Dandie Dinmont. It is a low road-side public-house, and, up to a comparatively recent period, justified the character given it in the novel, as the rendezvous of a very rude set of people; for, in fact, this district was the last haunt of the mosstroopers, and, after their suppression, the habits left behind them existed for some time.*

Dr. Granville seems to have been unfortunate in everything at Gilsland, and to have had a fit of the spleen besides. He thus expresses himself—"It is some consolation to one who has been taxed by the incredulous among his brethren with having too much vaunted the curative powers of mineral waters, whether abroad or at home, to find that even in places where little or nothing has been done by art or nature to make them desirable, pleasant, or agreeable residences, people of almost every class in this country will, if they are able, flock during the summer months, if there be but some spa or other in them. * * * * * The lower and middle classes of society have their 'spas,' as the great of the land have theirs at home as well as abroad. Now Gilsland is just such a place." He then describes the Irthing, a rocky mountain-stream, as issuing from the moorland, brown as London stout, which no doubt it is after heavy rains; otherwise a fine clear trout-stream. From the foot of a shale and sandstone cliff, about 100 feet high, the sulphur stream bursts in a full gush of clear sparkling water, just a few feet above the bed of the Irthing. Its analysis by the late Dr. Clanny gives in the pint—solids 2·93 grains composed of muriate of soda, with a little carbonate of the same; but no less than 2·10 cubic inches of sulphuretted hydrogen and 1·75 of carbonic acid gas. I further ascertained that a portion of the sulphur exists in the form of a sulphuret. Such a water must owe its properties entirely to the sulphur. It is not at all purgative, but possesses diuretic and diaphoretic properties, and is found to improve the digestion. It is also used externally in baths, but the bathing accommodation is not good. In skin diseases and affections of the liver, it has been found useful. Near the sulphur spa is a chalybeate of uncertain composition, containing sulphate of iron too strong to drink undiluted.

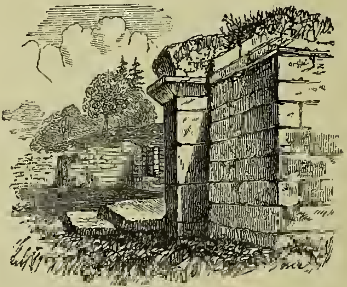
---

* Dr. Granville confounds Meg Merrilies with the hostess of Mumps Hall; so does Dr. Bruce in his "Roman Wall."

But Gilsland offers other attractions to the lover of nature and of antiquarian and historical information; and in these respects, and the bracing character of its air, is not surpassed by any spa in England, if indeed it do not stand alone. Although the climate is rainy—as the hotel occupies one of the highest table lands between the Irish Sea and the German Ocean—it is one of the healthiest spots in England; the registrar-general's returns for Haltwhistle district giving only a mortality of sixteen to the thousand living from the ten years' reports, 1841-50, being less than any other district, except one or two, in England. Well might Scott call the inhabitants "a hardy race by Irthing bred."

The remains of Triermain, and Naworth Castle, a noble relic of the past, are a few miles to the west. To the south-west, at the distance of about two miles, is the Roman station of Amboglanna,* which presents one of the finest specimens of a camp, and which has lately been excavated by Mr. Potter, of Hampton; the gateways will be found to show the sockets where the hinges moved, and grooves worn by wheels, and there are some good specimens of masonry.

To the east, the line of the wall and ditch can be distinctly traced, especially near the station of Caervoran (Magna), where it ascends some stupendous basaltic crags. To the north of Gilsland is a fine waterfall on the Irthing, which, when the river is flooded, presents a stupendous sight. The sport of angling may be had in abundance in the neighbourhood. In a word, if Gilsland be not pre-eminent for the medicinal properties of its spa, it is so as a place where fine bracing air and healthy exercise may be enjoyed in perfection. But the air is not calculated for very debilitated habits; it is more the sort of place for those whose digestive organs have been put right by the more powerful waters of Cheltenham, Leamington, or Harrowgate, and who are prepared for a more bracing atmosphere.†



ROMAN GATEWAY AT AMBOGLANNA.

---

* At Amboglanna a votive vase has been quite lately found, indicating a cure by some mineral water. Just where the Roman Wall leaves the valley to ascend the heights above Caervoran (Magna) is the stern black border-tower of Thirlwall, built out of the stones and on the foundations of the wall. According to tradition, here the Picts and Scots first broke through the wall.

† The hotel accommodation at Gilsland is sufficient, except at particular times. The summer is the only time at which the place is frequented.

## SHAP

May come next to Gilsland, and, though little known, is not to be despised; containing, it is true, only 47·80 grains of salts to the pint, but of these 26·26 are muriate of lime, being more of this substance than is contained in any spa in England, always excepting of course brine springs. It contains also traces of sulphuretted hydrogen gas. The water is tonic and diuretic; its chief use would be in scrofulous tumours and glandular diseases. There is convenience for bathing, and good hotel accommodation, but the neighbourhood is exposed and barren, without the interest of Gilsland. The place is now accessible by rail.

## SHOTLEY SPA,

About fourteen miles from Newcastle, enjoyed a temporary celebrity as a saline chalybeate, but is now hardly frequented, probably owing to the deterioration of the spot as a spa by the erection of immense iron and other works in the neighbourhood. According to the analysis of the late Mr. West, of Leeds, it contained nearly a grain of oxide of iron with twenty grains other solids in the pint, chiefly common salt, with 4·50 grains of muriate of lime.* Its chief use, also, would be in scrofula; and in fact it is in this class of affections and skin diseases that it has been chiefly used, externally and internally.

## TYNEMOUTH.

Near this sea-bathing place, which has a great local reputation, a little to the north, gushing from a rocky cliff, is a copious chalybeate spring, which might be well worthy of the attention of a visitor desirous of conjoining the use of iron with sea-bathing, as is done at Scarborough. The water was analysed by me several years ago, but I have not my notes of the analysis. It contains, if I recollect right, about eight grains of solids to the pint, with a sufficient quantity of iron to produce tonic effects. The water should be drunk copiously before breakfast and in the forenoon.

---

* Muriate of lime was particularly recommended by Hufeland in scrofula.

### CROFT AND DINSDALE.

These spas are in considerable request in the north of England, and access to them is easy by rail, the accommodation good, and the surrounding scenery pretty. They are generally similar in character. The chief characteristics of these spas will be soon described :—The old spa at Croft contains about 19·4 grains of solids in the pint, of which the chief ingredient is sulphate of magnesia, 9·26, with not quite a quarter of an inch of sulphuretted hydrogen. Such a water must have very feeble properties. It is used for bathing in a primitive kind of plunge-bath near the spa. The uniform temperature is 51°. The old spa is a natural well, as is also the Canniwell, a spa possessed of similar properties, whose water is conducted for baths to the pump-room at the new spa. This new spa was discovered by boring to the depth of twenty-two fathoms. According to the analysis of Mr. West, of Leeds, this water differs from the old spa in containing a very large quantity of sulphuretted hydrogen; its solids are much the same as the old spa, being 19·8 grains to the pint, of which 8·4 are sulphate of magnesia; but it is said to contain 2·78 cubic inches of sulphuretted hydrogen gas, which is more than any water in England. The recent experiments of Dr. Hofmann on the waters of Harrowgate have thrown doubt on the correctness of the old analyses of sulphuretted hydrogen waters in England, showing that a very considerable quantity of the sulphur existed, as in the French waters, in the form of sulphide or sulphuret. Dr. Granville complains of the water being pumped through leaden pipes, and attributes a disagreeable taste "to the presence of the leaden pipes plunged into the water producing sulphuret of lead, which falls in scales from the surface of the pipe into the water, contaminating the latter." But, as Dr. Johnson remarks, this is altogether a fantastic, visionary notion, not only with regard to this water, but others, for the salts in these waters would necessarily encrust the pipes with a deposit, which would tend to preserve from the further action of the water. In fact, in reporting upon the fitness of a water for domestic use, one of the questions which the chemist has to solve is, whether the water contains *enough salts* to encrust lead pipes, and to render it safe to pass the water through them. Pure water slowly dissolves oxide of lead; rain-water and some river waters, therefore, are not safe when passed through lead, or kept in bad tanks; and the distressing results that have been thus caused are well known. Water should contain about $\frac{1}{12000}$th part of salts at least to be safe. Those salts which protect the most are the sulphates and carbonates. If the water does not contain enough of salts, and lead pipes are to be used, it is prudent to run a weak solution of phosphate of soda through the pipes for some time before they are permitted to carry water. Now the carbonates and sulphates in Croft water, and the sulphuretted hydrogen itself, would be sufficient to protect the lead.*

---

* Some years ago a trial took place for the alleged poisoning of cattle and poultry by the crushing of lead ore in a brook. I was engaged for the defence. There was no smelting. The only thing that could do damage was the lead ore mechanically mixed with the water of which the cattle and poultry drank. The first question was—is lead ore poisonous? Dr. Christison says no; because it is not oxidated. Nevertheless the sulphur takes the place of oxygen, and other sulphurets, as that of antimony, analogous to lead, are by no means inert. I gave a dog at the time a large quantity of finely-pounded lead ore daily for a week without effect; but afterwards, from experiments on rabbits, I ascertained that the sulphuret of lead is poisonous, though less so than other preparations of the metal. Probably it is acted on by the free muriatic acid of the gastric juice, and converted into a more soluble chloride. Fowls when allowed to pick up small pieces of lead-ore, which they will swallow instead of gravel to aid their digestion, after a time frequently become thin, lose their feathers, experience symptoms of lead poisoning, and die. Doubtless the fine rubbing of the pieces of ore in their gizzards favours its action.

Dinsdale spa and hotel is about three miles below Croft, on the right of the Tees. The situation is charming; and, as Dr. Granville observes, well situated as a *maison de santé* during the summer months. Dinsdale water, according to Mr. Walker, contains 26·93 grains of solids to the pint, and 2·5 cubic inches sulphuretted hydrogen, with a little carbonic acid, as do the Croft waters. The chief ingredient is the sulphate of lime. The temperature of this water is 52°. There is every convenience for bathing.

With regard to the medicinal properties of these waters a great deal has been advanced, and very little need be said. If they, *i.e.* the new well at Croft and the Dinsdale waters, do indeed contain the large quantities of sulphuretted hydrogen ascribed to them, then no doubt they will act powerfully on the skin and kidneys. Their want of purgative power is evinced by the practice either of putting a little common salt into them, or taking purgatives at the same time. As baths they are no doubt likely to be beneficial in skin diseases. When cold sulphur waters are heated, a portion of the sulphuretted hydrogen is driven off, and may be inhaled, and thus produce some medicinal effect, for no gas acts more powerfully as a poison, and, of course, medicinal agent in small quantity. $\frac{1}{800}$th of it in air killed a dog, and $\frac{1}{250}$th of it a horse.

The chief use of the Croft and Dinsdale waters is in dyspepsia and hypochrondriasis; their utility in uterine affections seems very questionable.

At Gainsborough, in Yorkshire, is a weak saline chalybeate spring, which no doubt may be drunk with benefit by people in the neighbourhood. Indeed, throughout the northern counties, chalybeates abound, and several strong sulphate of iron, or copperas springs are known, similar to that much praised by Dr. Granville, at Horley Green. At Butterby, near Durham, is a sulphurous spring which rises in the middle of the river Wear. But none of these waters has any reputation as a spa. Proceed we then to Scarborough, once possessed of a reputation inferior only to

Bath, and denominated by Dr. Granville "the queen of English spas." If Bath be the king, and Scarborough the queen, what title are we to give to Harrowgate? The emperor, perhaps!

### SCARBOROUGH.

Unquestionably the praises which all writers have given to Scarborough are well merited. The situation at the foot of a high cliff, overlooking a fine bay; the venerable remains of the castle; the noble marine scenery of the coast, with the stupendous rocks and romantic caves of Flamborough Head; the arrival and departure of the fishing-boats; the many attractions of Scarborough itself; the neighbouring ruins of Rivaulx Abbey; the fine walks, and the union of perhaps the finest sea-bathing in Britain, with the possession of two valuable saline chalybeates, present a combination of elements which go far to justify all that has been said of Scarborough. In the vicinity, too, are many objects of attraction to the naturalist.

The first objects for consideration are the spas.

These are two, called the North Well and South Well; the former also called chalybeate, and the latter saline chalybeate. Both contain the same constituents. There is some difficulty about these waters; they have varied apparently at different times, and at one time their supply was more abundant. It is now very scanty, but sufficient for a water only used for drinking. Dr. Granville's report of Professor Phillips' analysis—which, so far as I know, is yet the most correct—differs from that given by Mr. West, in his Report on the Spas of Yorkshire;* but Dr. Granville's tables are manifestly incorrect. I give both. Both waters should be considered saline chalybeates.

The Scarborough water has, I believe, been found to vary by different chemists. I give Professor Richard Phillips' analysis, 1840.

---

* British Association Reports, 1844.

| | North Well. | Dry Salts. | South Well. | Dry Salts. |
|---|---|---|---|---|
| Chloride of sodium | 24·64 | 26·64 | 29·63 | 29·63 |
| Crystalline sulphate of magnesia | 172·68 | 69·60 | 225·33 | 109·91 |
| Crystalline sulphate of lime | 104·00 | 82·20 | 110·78 | 87·60 |
| Bicarbonate of lime | 48·26 | 26·23 | 47·80 | 26·00 |
| Bicarbonate of protoxide of iron | 1·84 | 0·87 | 1·81 | 0·86 |
| Total | 323·42 | 205·54 | 415·35 | 254·00 |
| Salts by direct evaporation | 212 grains | | 260 grains. | |
| Gas nitrogen | 6·3 cubic inches | | 7·5 cubic inches. | |

But Dr. Granville gives, as the result of Professor Phillips' analysis, in a pint imperial :—

| | North. | South. |
|---|---|---|
| Muriate of soda gas | 3·33 | 3·70 |
| Sulphate of lime | 17·83 | 28·17 |
| Carbonate of lime | 6·32 | 5·97 |
| Sulphate of magnesia | 17·83 | 28·17 |
| Carbonate of iron | 0·23 | 0·22 |
| Total solids | 45·54 | 66·23 |
| Gas (azote) nitrogen | 0·78 cubic inches | 0·84 cubic inches. |

According to any mode, these accounts are irreconcilable, and as Dr. Granville says that Mr. Phillips had just made the analysis, they must be the same from the date of Dr. Granville's first volume (Northern Spas), 1841.

One thing is clear—the patient drinking Scarborough spas, using especially the saline or South well, to the extent of three or four tumblers daily, may take a sufficient quantity of saline matter to keep the bowels open, along with a sufficient quantity of iron to produce a sensible effect. He should begin by drinking a couple of tumblers before breakfast; and he may take as many more in the forenoon after enjoying a bath in the sea; for it cannot be too often repeated that by far the best time for the invalid to take a cold bath is in the forenoon, when the digestion of breakfast may be supposed to be completed; not while it is going on, as the effect of the shock may be to interfere with digestion; then nothing can be conceived more likely to improve the stamina in habits debilitated by excess—a town life, hard study, and the various toils and cares of professional life—than a draught of such a mild chalybeate as Scarborough, where the iron is associated with gentle aperients and alteratives, so that it is not likely to congest the head. Then exercise should follow, visits to the interesting scenery of the neighbourhood, and another draught of the chalybeate about an hour before a moderate and wholesome dinner.

Dr. Granville avers that the saline chalybeate removed in his case an irritability of the stomach, caused, he thinks, by the Harrowgate waters, and recommends an autumnal visit to Scarborough after the system has been tolerably cleared out by the Harrowgate waters, to strengthen and brace it by the waters and sea-bathing. The merits of Scarborough water were first brought before the world by Dr. Witty, then of Hull. He lived contemporary and in great friendship with Dr. James Primrose, physician there, and the chief antagonist of the immortal Harvey, the discoverer of the circulation of the blood. Witty removed to York about 1656, whence he favoured the world with the first edition of his treatise on Scarborough Spas in 1660, May 29th, being the day of the Restoration. He left after several other editions an enlarged one in Latin in 1678. He was attacked by one Simpson and by a Dr. Tonstall, of Newcastle, and a furious contest was carried on, which reads very absurdly from the excessive darkness of the imperfect chemistry of the day which then shrouded the composition of mineral waters. The Royal Society was appealed to by all parties, and recommended moderation. Of what nature the arguments were may be judged by the mode in which Dr. Short, who narrates the dispute nearly 100 years after, speaks of the composition of mineral waters. After some very judicious observations on the action of water itself,* he says—

---

* They are worth quoting, as a specimen besides of the language of the day. "Hereby water mixed with the blood affects the solids, removing their resistance, opening their canals, rendering them flexible that the other parts of the blood may have free course. It acts upon the fluids by diluting and mixing their parts, preventing or disentangling their cohesions, and moleculæ, which might be the occasion of obstructions in the small

"But after the common vehicle and assistants, let us next inquire into the contents themselves; and first, to prevent mistakes in our search, and that our expectations may not be frustrated, let us see what things they contain. Not, *e. g.*, sal ammoniac, though some have sought and pretended to find it in mineral waters, yet, it being a composition of sea-salt, soot, and slime, we are not to look for it there. There are also several kinds of sulphur which we are not to expect to find, nor the natrum or natron of the ancients, nor factitious salts, these being not the products of nature, but of human invention, as sal glauberi, polychrest, &c., nor vegetable salts, as salt of tartar, nor animal salt."* Sal glauberi, or sulphate of soda, and sal polychrest, or sulphate of potash, are both constituents of mineral waters.

The spas are close together in a handsome new building, surrounded with tasteful grounds, and accessible on a small payment.

It is singular that this water should not contain alumina, which is known to be present in the contiguous strata, and which is so often associated with iron.

The curious museum at Scarborough, where is the skeleton of the ancient Briton in his oak coffin, so celebrated, and many geological objects of interest, a visit to Whitby, and

---

vessels, it sheathes, dissolves, and breaks the acrid saline parts of the blood, and so promotes and hastens their discharge out of the body, it fuses the thick viscid and sizy parts; and yet keeps up their new magnitude and tendency to one another. It recovers the natural resistance of the vessels, and takes off the constriction of the fibres. Water is an alterative, being the best diluter or thinner of the blood; the greatest relaxer when drunk warm, and yet a constrictor taken cold; and as it is a diluter and dissolver, so it is an aperient and attenuator; as it dissipates coagulated and stagnant humours in the vessels, it is a discussive, and by increasing the blood's quantity and motion, forwarding secretions, hastening regularly the evacuations, so as the useless superfluous parts being carried off, the globules come nearer to contact with one another." . . . "Cold water produces appetite. In fevers the use of warm water cannot be too much extolled. Hoffmann very justly observes that the efficacy of mineral waters in softening inveterate obstructions of the viscera has a great dependency upon the quantity and goodness of mere water. However the mineral runs away with the praise of it."

* History of the Mineral Waters of Derbyshire, Lincolnshire, and Yorkshire, &c. By T. Short, M.D., Sheffield. London, 1774.

its alum strata, the caves of Flamborough, and the intellectual amusements which Scarborough affords, will agreeably fill up the time of the visitor. Boating excursions and rides along the shore are easily to be had.

Dr. Granville, I observe, says that the climate of Scarborough is, from his observations, or rather from observations taken on the spot, milder than that of London, and nearly as mild as that of Torquay, and that the longevity of the people, claimed by them to be higher than that of other parts of Yorkshire, is borne out by the local registrar's reports. But this is not borne out by the Registrar-General's report for the average of the years from 1841 to 1850. The annual mortality there is set down for 21 to 1000, while in the district of Easingwold, in the North Riding, it was only 17, and at Gainsborough, quite near, only 16.

The visitor should ride or walk to Filey, between Scarborough and Flamborough Head. He will there find a fine bathing site and a spa, which, according to the analysis of Mr. West, should possess considerable medicinal power. In fact, its composition is so very striking, that if the analysis be correct, it should possess corresponding properties. He gives in a gallon:—

| | Grains. |
|---|---|
| Sulphate of magnesia | 48·96 |
| Chloride of magnesium | 36·40 |
| Chloride of calcium | 41·20 |
| Chloride of sodium | 210·80 |
| Carbonate of soda | 58·08 |
| Total | 395·44 |

So that here is a water more highly charged with alterative salts than many spas; and besides, with the advantage of possessing a large dose of carbonate of soda, in fact as much carbonate of soda as would form, if a tumbler or two were drunk, nearly as much as is generally contained in soda water.

The existence of this water so near should be considered an additional advantage to Scarborough. It would not at all interfere with the waters of the place, and besides would be more antacid.

One cannot help being struck, when writing of our English sea-bathing places, with the advantages which in this respect our country enjoys over almost all the countries of Europe. In exchange for the German spas, it might be well if many of the continental nations were to avail themselves of the facilities which England offers, and of the contrast between the low German and Dutch coast and the rocks and swelling downs of England, of the brackish Baltic or waters of the Dutch coast, loaded with the slime of the great rivers of eastern France and Germany,

> "The pale discoloured sea
> Which sleeps upon the reedy shore,"

and the fresh and green German Ocean, and exchange these scenes occasionally for the eastern or south-eastern coast of England. The tideless Mediterranean, too, except for swimmers, in many parts of the coast presents such *debris* as does not render bathing very desirable in these localities.

The waters of the ocean present great differences of density in various parts, and of course their contents vary correspondingly. Perhaps the following table of specific gravities may be interesting:—

| | Specific Gravity. |
|---|---|
| Icy Sea | 1·00057 |
| Baltic | 1·01523 |
| White Sea | 1·01901 |
| Black Sea | 1·01418 |
| Marmora | 1·01915 |
| Yellow Sea | 1·02291 |
| Mediterranean | 1·02931 |
| German Ocean | 1·02740 |

The general estimate of the salts is 3½ per cent. The analysis of some of the principal constituents by MM. Mialhe and Figuier in Chapter 2, gives a higher estimate of bromine than is usually given.

It may be well to state here the generally received analysis of Mr. Schweitzer of water at Brighton. The specimen of Mialhe and Figuier was taken at Havre.

Mr. Schweitzer makes in 1000 parts:—

| | |
|---|---|
| Water | 964·74372 |
| Solids | 35·25628 |
| Chloride of sodium | 27·05948 |
| Chloride of potassium | 0·76552 |
| Chloride of magnesium | 3·66658 |
| Bromide of magnesium | 0·02929 |
| Sulphate of magnesia | 2·29529 |
| Lime | 1·40662 |
| Carbonate of lime—(magnesia) | 0·03301 |

There is no reason, it has been said, why sea-water should not be more used than it is as a tonic and alterative. In scrofulous affections a tumbler of it twice a day will be found a powerful auxiliary to sea-bathing. In children smaller quantities might be given. There is every ingredient in sea-water requisite to constitute a saline spa of the first class, and it is not insupportable like some of our brine springs.

# CHAPTER V.

Harrowgate.—First discovery of a Chalybeate.—Its admirable situation.—Analysis of its Springs.—Dr. Hofmann's Analysis.—Origin of the Sulphur Springs.—Cases in which the Waters are useful.—Fast-livers.—Skin Diseases.—Dyspeptic Cases.—Precautions.—The Starbeck Water.—Eruption produced by the Waters.—Paralysis, Gout and Rheumatism, Scrofula.—Environs of Harrowgate, Knaresborough.—The Dropping Well.—Eugene Aram's Line of Defence.—Minor Spas in Yorkshire.—Aldfield, Hovingham, Thorpe Arch, and New Malton.—Askerne, Horley Green, Slaithwaite, Ilkley.—Hydropathy, its practice.—Diseases in which it may be useful and injurious.—Turkish Baths.

## HARROWGATE.

For the power and variety of its mineral waters, combined with the attractions of a healthy and interesting country, Harrowgate stands unsurpassed in Great Britain, and perhaps hardly surpassed in the world. There is but one thing wanting to complete the capabilities of its springs—they are not thermal. Had there been one or two springs of this character, the patient need not have gone beyond the bounds of Britain in search of a spa suited for almost every complaint. They are also deficient in sulphates, and not aerated by any considerable quantity of carbonic acid.

The first discovery of a spa at Harrowgate was by Mr. W. Slingsby, in 1551. This gentleman had been accustomed to use Spa, and his attention being directed to the Tewhit spring, he was led to use it instead, and found great benefit. The old Sulphur well was shortly afterwards discovered, and an account published by Dr. Dean, of York, in 1626, giving a curious list of cures by the Tewhit and sulphur wells at "Harrigate." At that time the country was very rude. Dr. Dean says, "Many parishes here about have not divine service above once in a year; a frequenter encouragement might do well."* The spas have made Harrowgate what it is, with the advantage, as Dr. Granville observes, that it still possesses, with all its hotels and handsome places of resort, the appearance and much of the openness of a village. This arises from the large open ground called the spray, which completely breaks the continuity of the place, and around which many of the establishments are placed, while it affords an admirable airy ground for promenades in the immediate vicinity of the various springs, both chalybeate and sulphur.

The first point of consideration at Harrowgate is the springs and their properties.

The old analyses of these were meagre indeed to those which we now possess. The subject of the analysis of Harrowgate waters is so important, that it will necessarily take some space. All the old analyses have been set aside by the recent one of Dr. Hofmann; and as the results which he has arrived at not only interest in themselves, by throwing new light upon the action of the waters, but mark a new era in this country as regards the chemical examination of its waters, it will be necessary to give some of the old analyses, in order to mark their extraordinary contrast with the analysis of Dr. Hofmann. In the first place Dr. Granville's tables are as mysterious here as at Scarborough. The contradictions there could not be accounted for by miscalculation. In the analysis of the old Sulphur well, he gives in the pint imperial:—

| | Grains. |
|---|---|
| Muriate of soda | 108·47 |
| Bicarbonate of soda | 2·50 |
| Muriate of lime | 10·87 |
| Sulphate of lime | 1·00 |
| Carbonate of lime | 1·50 |
| Muriate of magnesia | 5·30 |
| Carbonate of magnesia | 0·10 |
| Total | 127·74 |

---

* Dr. Short, op. cit.

| | | Cubic Inches. |
|---|---|---|
| Gases :— | Sulphuretted hydrogen | 1·93 |
| | Carburetted hydrogen | 0·85 |
| | Nitrogen (Azote) | 1·10 |
| | Free carbonic acid | 1·13 |

on the authorities, Scudamore, 1830, and Hunter, 1819; but he states that these authorities differ considerably.

But Scudamore himself gives the following as his analysis of the old well. In a *wine* gallon :—

| | Grains. |
|---|---|
| Muriate of soda | 760·0 |
| Muriate of lime | 32·0 |
| Muriate of magnesia | 28·0 |
| Sulphate of lime | 32·0 |
| Carbonate of lime | 12·0 |
| Carbonate of magnesia | 3·2 |
| Loss | 4·8 |
| Total | 848·0 |

Which, reckoning the imperial gallon to the wine gallon as 277 to 231, gives for the former a total of 1168 and some decimals; while, according to the statements given in Granville, the total quantity in an imperial gallon would be 1021·92. Again, Sir Charles Scudamore gives as his last analysis of the gases :—

| | Cubic Inches. |
|---|---|
| Sulphuretted hydrogen in the wine gallon | 13·760 |
| Carbonic acid | 9·529 |
| Azote, carburetted hydrogen | 5·800 |

Mr. West, in the report alluded to, in speaking of Scarborough, gives as his last analysis of Harrowgate old Sulphur well in the imperial gallon :—

| | Grains. |
|---|---|
| Chloride of sodium | 872·4 |
| Chloride of calcium | 94·1 |
| Chloride of magnesium | 45·7 |
| Carbonate of soda | 34·8 |
| Total | 1047·0 |

| | | Cubic Inches. |
|---|---|---|
| Gases :— | Sulphuretted hydrogen | 15·6 |
| | Carbonic acid | 2·72 |
| | Carburetted hydrogen | 6·86 |
| | Nitrogen | 8·82 |

Now it is true that the waters will vary somewhat: the saline matter of the old Sulphur well, according to Dr. Bennett, of Harrowgate, in the year 1841, varied from the highest of 108 grains to the lowest of 90 in the wine pint; in 1842, from the highest of 114·8 to the lowest of 108·8, which would give the highest quantities of all for the imperial gallon 1101, and the lowest 1079, decimals excepted. Now Dr. Hofmann gives for the old Sulphur well 1096·580 grains in the imperial gallon.* Dr. Bennett found the sulphuretted hydrogen on the whole pretty uniform. We know, however, from variations in atmospheric pressure, the gases will vary considerably, and will escape from a water more freely, too, when the pressure is low. The important point with regard to the differences between the old and new analyses, is the difference in the ingredients. Dr. Hofmann reckons no carbonate of soda in the Sulphur well, and he makes out that it contains no less than 64·701 of chloride of potassium, a most important salt, of which the old analyses make no mention. He finds traces of the bromide and iodide of sodium, but he gives no less than 15·479 of the sulphide or sulphuret of sodium, leaving only 5·31 for free sulphuretted hydrogen. Instead of eight grains of sulphate of lime, he only makes 0·132; he gives no carbonate of magnesia, but traces of ammonia, manganese and iron, and a small quantity of silica. The analysis of the other springs differs equally, but it would exceed the limits of this work to pursue the subject further.

Four of Dr. Hofmann's tables are given as follows :—

---

* It is to be hoped that in future no one will use any measure in such researches except imperial measure, or weights but those in use. I see M. Herpin complains of the immense trouble he has had with different weights and measures in France and abroad, and I have now the same thing to encounter.

# *Grains of Solid Contents in an Imperial Gallon of the Sulphur Waters at Harrowgate.*

| | Old Sulphur Well. | Montpellier Strong. | Montpellier. Mild. | Hospital Strong. | Hospital Mild. | Starbeck. |
|---|---|---|---|---|---|---|
| Sulphate of Lime | 0·132 | 0·594 | 12·104 | 51·660 | 1·215 | 0·870 |
| Carbonate of Lime | 12·365 | 24·182 | 20·457 | 25·560 | 19·794 | 6·960 |
| Fluoride of Calcium | trace | trace | trace | trace | — | faint trace |
| Chloride of Calcium | 81·735 | 61·910 | — | — | — | — |
| Chloride of Magnesium | 55·693 | 54·667 | 17·140 | 11·595 | 0·334 | — |
| Carbonate of Magnesia | — | — | 3·251 | 5·797 | 10·310 | 5·390 |
| Chloride of Potassium | 64·701 | 5·750 | 3·975 | 10·751 | 24·970 | — |
| Carbonate of Potassa | — | — | — | — | — | 12·207 |
| Chloride of Sodium | 866·180 | 803·093 | 232·413 | 369·014 | 220·630 | 121·798 |
| Bromide of Sodium | trace | — | trace | trace | trace | trace |
| Iodide of Sodium | trace | — | trace | trace | trace | trace |
| Sulphide of Sodium* | 15·479 | 14·414 | 3·393 | 7·155 | 0·301 | 1·711 |
| Carbonate of Soda | — | — | — | — | — | 5·133 |
| Ammonia | trace | trace | trace | trace | trace | trace |
| Carbonate of Iron | trace | trace | trace | 1·060 | trace | trace |
| Carbonate of Manganese | trace | trace | trace | trace | trace | trace |
| Silica | 0·246 | 1·840 | 0·165 | 0·535 | 1·490 | 1·753 |
| Organic Matter | — | trace | trace | 1·327 | trace | 1·740 |
| Total Solids. Grains | 1096·580 | 966·456 | 292·903 | 437·966 | 279·046 | 157·562 |

---

* Sulphuret of Sodium, or Hydrosulphate of Soda.

*Grains of Solids in the Harrowgate Chalybeate Waters in an Imperial Gallon.*

| | Montpellier Saline Chalybeate. | Cheltenham Saline Chalybeate. | Tewhit Spa. | St. John's Well. |
|---|---|---|---|---|
| Sulphate of Lime | — | — | 0·697 | 0·307 |
| Carbonate of Lime | — | trace | 1·435 | 2·244 |
| Fluoride of Calcium | — | trace | — | ? |
| Chloride of Calcium | 159·278 | 51·629 | — | — |
| Chloride of Magnesium | 35·635 | 34·027 | — | — |
| Carbonate of Magnesia | 41·796 | — | 2·667 | 3·039 |
| Chloride of Potassium | 11·383 | 27·410 | 1·323 | — |
| Carbonate of Potassa | — | — | 1·057 | 0·991 |
| Chloride of Sodium | 656·838 | 158·840 | 0·280 | 1·543 |
| Bromide of Sodium | trace | trace | trace | ? |
| Iodide of Sodium | trace | trace | trace | ? |
| Carbonate of Soda | — | — | — | 1·338 |
| Ammonia | trace | trace | trace | trace |
| Carbonate of Iron | 2·790 | 4·627 | 1·358 | 0·609 |
| Carbonate of Manganese | trace | trace | trace | ? |
| Silica | 0·947 | 1·450 | 1·041 | trace |
| Organic Matter | trace | 0·282 | 0·663 | trace |
| Total Solids. Grains | 908·667 | 285·869 | 11·021 | 10·091 |

## *Gases in the Gallon of Harrowgate Waters.*

| OLD SULPHUR WELL. | Cubic Inches. | Montpellier. Strong. | Montpellier. Mild. | Hospital. Strong. | Hospital. Mild. | Starbeck. |
|---|---|---|---|---|---|---|
| Carbonic Acid | 22·00 | 14·01 | 14·28 | 9·54 | 10·20 | 9·26 |
| Carburetted Hydrogen | 5·84 | 0·53 | 0·91 | 0·15 | 5·28 | 5·15 |
| Sulphuretted Hydrogen | 5·31 | — | — | 0·54 | — | trace. |
| Oxygen | — | 0·48 | — | — | 1·81 | — |
| Nitrogen | 2·91 | 4·82 | 7·67 | 19·78 | 5·87 | 4·21 |
| Total | 34·09 | 19·84 | 22·85 | 38·01 | 13·16 | 18·62 |

## *Gases in the Gallon of the Harrowgate Chalybeate Springs.*

| | Montpellier Saline. | Cheltenham Saline. | Tewhit. | St. John's. |
|---|---|---|---|---|
| Carbonic Acid | 24·17 | 19·50 | 11·85 | 14·95 |
| Carburetted Hydrogen | 2·40 | 5·00 | — | 0·15 |
| Oxygen | 0·51 | — | 0·40 | 0·67 |
| Azote | 6·48 | 1·01 | 5·53 | 6·30 |
| Total | 33·56 | 25·52 | 17·98 | 22·12 |

Nothing can account for differences in not merely the proportions but the nature of the ingredients, except differences in the modes of analysis. Among the valuable results of these analyses of Dr. Hofmann, is the presence of a large quantity of potash-salt, the chloride, in the old Sulphur well, and a fair quantity of the same salt in the other sulphur spas, except the Starbeck, which in exchange contains a proportion of carbonate of potash with carbonate of soda. In fact, potash in one form or another is shown to exist in all the Harrowgate waters, while its existence was not named in the old analyses. Now the chloride of potassium is a very active salt, much more so than the analogous salt of soda, common salt, and only inferior in activity to its corresponding salt, the iodide of potassium; salts of potash are supposed to be peculiarly anti-scorbutic, and the presence of the carbonate of potash with some carbonate of soda in the Starbeck water is sufficient to give it an alkaline character.

Of all the sources it will be observed that the old chalybeates—the Tewhit and St. John's Well—are by far the weakest in solid constituents, being almost pure water, except for their not very strong impregnation of iron, although they first brought fame to Harrowgate. As accessories to the other waters, they are not to be despised. The Cheltenham saline chalybeate, as an alterative saline chalybeate, seems to possess the very constitution required. More than double the strength of the Scarborough saline in iron, it contains muriates (chlorides) instead of sulphates, and especially the chloride of potassium, and, therefore, may be supposed less likely to act as an aperient, and more so to enter the system. The Montpellier saline, on the other hand, is not much inferior in saline constituents to the old Sulphur well, although less charged with iron than the Cheltenham saline. But the glory of Harrowgate is in the Sulphur wells, of which it possesses many minor ones, besides those whose composition has been determined by Dr. Hofmann, containing quantities of sulphur in the form of gas or sulphuret, answering every degree of sulphuration, and admitting of the use of this kind of water, being graduated to any degree of toleration of the patient for the remedy, or fitness of his disease for its use.*

The sulphur springs at Low Harrowgate have generally been supposed to have their origin in the great bog to the west of the baths and wells, where there are several wells filled with water of similar composition. Dr. Saunders says —"The sulphurous springs, four in number, all appear to take their rise from a large bog, a black fœtid fluid mass, resting on a bed of clay. Hence the water appears to pass underground through strata of shale, and having undergone a natural filtration in its passage, it rises perfectly transparent into the wells where it is received for the use of the numerous invalids that frequent this place." Against this view there is the absence, or very minute quantity of organic matter in the waters; for no amount of filtration will get rid of organic matter in solution, and the absence of sulphates whose decomposition might account for the presence of sulphuretted hydrogen; then the slight extent to which springs of such quantity of solid contents are affected by rains, the uniform temperature of the springs in summer, always higher than the ordinary springs in the neighbourhood. In winter, according to the observations of Dr. Bennett, when the temperature had fallen to 29°, never lower than 41°, proving that they come from a great depth. According to Professor Phillips and others, through some great convulsion of nature, a fault or fissure extends through the calcareous and shaley rocks of this part of Yorkshire; and on this line of disturbance most of the sulphur springs are found. Those springs on this line which are on a lower level do not derive their supply from those at a higher; but each springing from its own deep source, has no influence on the properties of the other. This is verified at Harrowgate, where the separate springs, although in such close proximity, have for years exercised no power the one on the other.

---

* A weak sulphuretted saline spring has lately been brought into notice at Harlow Carr, about two miles from Harrowgate.

It is true, according to Dr. Bennett, the Harrowgate springs do vary somewhat, being more diluted in very wet seasons; the difference is to such a comparatively slight proportional extent as cannot materially affect their properties.*

The great consideration now comes to be—to what uses are these most potent springs applicable; in what cases are they likely to do harm; what springs should be selected for use; how should they be employed; and what precautions should be taken during their use.

A class of patients is very common at Harrowgate, generally known as *fast livers*, and, if a bad pun may be tolerated, *fast livers* they often have. Men who have realized wealth, perhaps suddenly, in commerce—of the middle age or past it, not much given to intellectual pursuits, fond of good living, as they themselves might express it, "in all its branches." Such a class the great manufacturing towns of the North send forth in shoals to get, to use their own phraseology again, "a good clearing out by means of Dr. James Johnson's 'Yorkshire Stingo.'" For such cases the sulphur saline waters are so well adapted, and this locality so fitting, that one might almost imagine them created as means contrived by Providence for an end, as Peruvian bark is found in a region of intermittent fevers, and kousso, the most efficacious remedy for tape-worm, in Abyssinia, where that disease is so prevalent.

---

* Dr. Bennett finds the substance glairine in several of the springs in the bog and at Wilton Wood, where, he says, he has frequently seen and collected a filamentous substance, soft, gelatinous, of a yellowish white colour; he found the organization of the fibrillæ to be similar to that of the order Tremella; they evidently came up with the spring. He also found a species of aquatic plant attached to the sides of the basin, "presenting a jagged surface of a dark-green colour, studded with a number of small globular bodies attached by slender pedicles, each enclosing a small bubble of air, which thus gives them a silvery appearance."—*Report on the Sulphur Springs of Harrowgate for the years* 1841 *and* 1842. By W. Bennett, M.D. A very valuable summary indeed.

Such cases are characterized by general, though false plethora, by a tendency to congestion of the head, irregular pulse, loaded tongue, want of appetite, sleeplessness, disinclination to exercise, torpid bowels, feverish, uncomfortable skin, and scanty secretions of all kinds; frequently by flying pains, pains at the top of the shoulder, often fixed pain in the right side, and tenderness of the abdomen. Mild aperients and alteratives, with something that will effectually depurate the blood, are clearly what is required. Strong purgatives, which such parties might take at home, are very likely to do harm. All that is wanting is found at Harrowgate, in the way of physic, with the addition of good air and the means of taking exercise graduated to the increasing strength. The salts of the waters act upon the stomach and bowels, restore the secretions, stimulate the liver to action, excite the appetite, and, assisted in all these operations by the sulphur, are especially directed by that element of the waters on the skin and kidneys. Such cases generally bear the strong sulphur waters of the old Sulphur and Montpellier wells from the first. If any preparation is required, it may consist of one or two compound rhubarb pills, for two or three alternate nights, and counter-irritation, where there is much irritation of the stomach and bowels, by a blister applied over the abdomen, or in mild cases, a sinapism or frictions of turpentine. The ordinary mode of taking the sulphur water at Harrowgate, viz., by two tumblers, hot or cold, early in the morning, is as good as any mode; and a couple of half-pint tumblers of the Cheltenham saline might be taken in the course of the forenoon. The forenoon should be spent in exercise if the weather admits, or in light amusement at some of the places of resort. With this treatment, an occasional bath should be conjoined if there be not much congestion of the head, when also the chalybeate should be carefully used, or not used at all. There is a notion at Harrowgate that the sulphur waters may interfere chemically with the chalybeate, which I believe not to be well-founded, especially if an interval of several hours be allowed to elapse before the chalybeate is taken. Where there is much congestion of the head, shower-baths will be beneficial. During the course of the treatment, if the bowels do not sufficiently act, a dose or two of the compound rhubarb pill may be taken.

But the diet—ay, there's the rub. How often is the morning draught, the forenoon promenade, counteracted by a heavy dinner and copious afternoon and evening potation, and the social haunts of the "George" and the "Swan" resound too soon, not with the classical "Io Io Pæan" of Akenside, but with more boisterous hilarity, leaving behind morning symptoms which it requires all the potency of the old Sulphur well to dispel, even if it do not aggravate them. In all such cases temperance is essential to a cure. The general directions in the preceding Chapter (3) are referred to; but in all this the patient must minister to himself.

The next class of diseases in which most benefit is expected from the waters of Harrowgate is the numerous class of skin diseases. It is only of late years that people have become sensible of the very important fact that the skin is an organ which performs functions essential to life, and not merely a shield or covering to the rest of the body. The skin excretes about two pounds of fluid daily, and this carries off from the blood a quantity of salts and also effete matters, similar to those more especially excreted by the kidney. Common observation satisfies every one that the two organs are vicarious of each other; that excessive perspiration checks the function of the kidneys, and *vice versâ.* The outward skin and the mucous membranes of the internal organs and bowels are essentially similar.* The inverted skin in the form of mucous membrane penetrates as a lining all the internal organs into the interior of their recesses and ducts. Hence, in the language of medicine, the whole interior surface of the body sympathizes with the external surface. Diseases of the skin often have their origin in diseases of the internal organs, especially in depraved secretions, and when the functions of the skin suffer from disease, the internal organs are apt also to suffer. Sometimes, too, a disease of the skin is a kind of revulsive effort of nature to throw off internal disease; hence the importance of a mode of cure which may effect the object both by restoring the internal organs and their secretions to a normal or natural state, and render the skin itself healthy. For the attainment of such a purpose the use of the mineral waters of Harrowgate, sulphur kind, with the usual adjuncts, seems well adapted. The skin diseases most likely to be benefited by the use of the waters are of the chronic kind, such as eczema, or tetter, lepra or psoriasis (leprosy), and especially a class of skin diseases in persons of depraved and debilitated habit of body, the result of intemperance and the abuse of mercury—a numerous class of anomalous skin affections; several of the forms of pimples, and pustular diseases may be added to the list. It is to be observed that in skin diseases, one great object should be to get the sulphur into the system, so as to act specifically on the skin, and this will be prevented if purging be induced. It is true that the aperient action of the water may be useful by acting as a derivative from the skin, and restoring a healthy state of the bowels; but experience seems to have taught that it is better to get the water into the system, and trust to the alterative action of the sulphur. Experience has taught Dr. Bennett, who naturally has had much opportunity of observation at Harrowgate, that it is often better to begin with the weaker springs, of which there are many at Harrowgate, than all at once to use such strong springs as the old Sulphur and Montpellier. He remarks that this is in accordance with the practice of our continental brethren to trust to spas which have less action on the bowels than our springs, and which, not disturbing the digestion, can be taken for a long period, and in large doses, until at last a state called by the French writers the *poussée* occurs, denoted by a minute rash not always florid, attended with itching, and an enlarged state of the papillæ of the skin, brightness of the eyes, restlessness at night, often attended with headache, urine often scanty, increased frequency of the pulse, and, in fact, general febrile state. This is what is called by German writers the " bad-sturm ;" when it is produced, the local disease, whether cutaneous, rheumatic, or nervous, is very often worse; but it is almost always a sure sign that a salutary crisis is at hand, to be followed by a decided improvement. After this the strong waters would more securely complete the cure and be better borne. Often in these dyspeptic cases, accompanied with skin disease, the strong waters at first produce headache and nausea. The Starbeck water seems well adapted for such cases, especially when much acidity is present. This is often increased by the strong sulphur waters, probably from the evolution of their sulphuretted hydrogen, itself an acid; perhaps, Dr. Bennett suggests, from the decomposition of their chlorides. Now the Starbeck contains, as the analysis shows, a quantity of the alkaline carbonates, and is therefore the very water for such cases, especially as carbonate of potash itself, of which it contains so much, is an approved remedy in skin diseases. The stronger waters, in such cases, often occasion heavy eructations. In cutaneous diseases, hot bathing of course will be conjoined with the use of the waters, except in cases of congestion of the head, palpitation of the heart, and such like signs of internal disease. When such symptoms are present, the patient will of course be guided entirely by his physician as to what form of external application of the waters he should use.

---

* The great importance of the skin is well shown by those experiments, however cruel, in which Magendie covered the skins of animals with an impermeable coating of viscous mixture; however entire the play of the lungs, the temperature of the animals rapidly sunk, and they died in a few hours, as if asphyxiated.

With regard to the eruption alluded to, a few years ago I spent some time at Harrowgate, and drank the old Sulphur spa every morning, and the Starbeck often in the forenoon. The period was the end of June, just before York Assizes, to which I was subpœnaed on a chemical trial, and the weather being uncommonly fine, I took much exercise on foot, visiting the principal places in the neighbourhood, and living rather freely. Almost every night after getting into bed, and becoming warm, I was seized with an intolerable itching of the skin, with a stinging or prickling sensation which I can compare to nothing but the effect of the horrid fleas, afterwards to be felt too well in the Barrack Hospital of Scutari.* This was followed by profuse perspiration. I satisfied myself that it was owing to the effect of the large doses of the water.

Dr. Bennett says that in the dyspeptic patients who resorted to him at Harrowgate, he could distinguish two classes, comprising persons in the middle period of life; in the one the powers of the stomach had been impaired by excessive mental exertion, and in the other congestion of the liver had paralysed the muscular energy of the duodenum, and a secondary reaction on the stomach gave rise to a train of symptoms nearly similar in both cases, and usually denominated bilious, and in fact very similar in character to those already described as occurring in the first class of patients frequenting Harrowgate, with excessive acidity, and in general a want of elasticity and muscular energy to shake off the internal weight which seemed to oppress the system. He says he is convinced that these should not indiscriminately use the strong sulphur waters. Some, he says, of both these classes cannot take the waters without headache; in others they will run off by the kidneys in spite of every precaution, and, constipating the bowels, demand the same routine of pills; this latter a never-failing source of vexation. Then there are cases where the waters are well borne, the bowels act freely, and all the other secretions and the appetite improve; but where, if the course be too long persevered in, congestion of the brain occurs. In all these cases benefit is derived from the occasional use, either at the beginning of the course or after a time, of the weaker springs, and especially the Starbeck.

---

* The only remedy for these monsters—for as such they were more dreaded than the bugs, mosquitoes, rats, and other vermin of that vast prison—was to fill the bed with Persian powder, like snuff, the powdered leaves of a kind of groundsel. This kills some of the fleas and stupifies others, so that next morning they could be killed by hundreds. The supply at one time failed at Pera, and then the only remedy was to use camphor instead; but it became volatilized, and caused anæsthesia.

In cases of paralysis, benefit can only be expected where there is absence of organic disease of the brain and spinal cord; then by restoring the secretions these waters may be useful. Where there is absence of cerebral congestion especially, the strong and weak waters used internally may act beneficially on the bowels, skin, and kidneys. Hot baths also may be used. In no class of cases does the use of these waters require more judgment and more precautions, and as a general rule the benefit cannot be great.

In the whole class of gouty and rheumatic cases, great benefit has been derived from the waters of Harrowgate, chiefly from the use of the strong sulphur waters. The same general precautions are required as in other cases. Concealed gout has made its appearance in the course of the use of the waters, and the result being the relief from the numerous anomalous symptoms which in such cases are often present. Concealed gout may be the cause of dyspepsia, of asthma, of extraordinary pains, and nervous symptoms of a Protean character. Where it is difficult to discover the cause of such symptoms, and there is a hereditary tendency to gout—especially if the person present symptoms of liver disease, show sediments in the urine, be past the middle period of life, and have lived freely—the existence of a latent gout may be suspected. The waters in such cases present a safe, and often an efficacious mode of eliminating the disease. A long-continued course may be required, during which the state of the bowels should be attended to. Here the gout brought out is often announced by pulmonary excitement and irritation.

Amongst the host of diseases for which Harrowgate is frequented, scrofulous affections may be mentioned. They are often popularly confounded with skin diseases which have nothing scrofulous in themselves, although very common in scrofulous habits. Scrofula is when the scrofulous or tubercular matter—a crude, unorganized, or little organized albuminous mass—is thrown from the blood into any organ, forming swellings of the glands or tubercles in the lungs, and exciting irritation in the surrounding tissues.

The great object in such cases is to alter the state of the blood, which, as already stated, is at the bottom of the mischief, and which itself is caused by an error in digestion; to attend to the state of the organ which is the seat of the disease; and to get rid, if possible, of the scrofulous matter. Among the remedies for improving the state of the digestion, cod-liver oil has of late years come into great use; it has also been put forward by the distinguished man who first introduced it into this country, Professor Bennett, of Edinburgh, as having a kind of mechanico-vital action in working up the excess of albumen in the blood into blood globules. Its uses do not come before us here. Besides this substance, the preparations of iron, and the saline chlorides, bromides, and iodides, have been held of most essential value,—the preparations of iron, by their tendency to improve digestion and increase the number of red globules in the blood; the saline class mentioned as tonics and as alteratives, increasing the amount of solids excreted, and so promoting the absorption and elimination of the effused albumen, while at the same time they improve the tone of the system. At Harrowgate the saline chalybeates present the required union of iron and chlorides. The best of these for this purpose would seem to be the Cheltenham saline. Three or four tumblers of it daily, or two tumblers with a dose of the pure chalybeates in the Tewhit, would seem to be a dose suitable for a person at the age of puberty, and it might be alternated with the sulphur water occasionally.

Countless are the forms of disease which present themselves at Harrowgate; to enumerate them would exceed my limits. I have endeavoured to comprise in the foregoing the cases most likely to be relieved, and to indicate the contra-indications and precautions to be taken. In phthisis, in inveterate malignant affections and diseases of the bones, in advanced organic diseases of the heart, brain, spinal cord, or kidneys, no good can be expected from those waters. Perhaps chronic diseases of the liver may be excepted. In a mere tendency to phthisis, especially in young females, where there is deficiency in important functions, the mild sulphur and chalybeate waters may do good used alternately, or the sulphur water early in the morning, the chalybeate at a later period of the day.

By the mild sulphur waters I understand those so designated in Dr. Hofmann's table, and especially the Starbeck or Knaresborough spa, of whose value I entertain a very high opinion; but there are many other "mild" sulphur springs in Harrowgate and its vicinity.

Harrowgate is situated on a table land nearly midway between the two seas. Its climate in winter is immaterial, since it is only frequented in the summer and autumn.* Open on every side to the breezes, at these periods the air is tempered and bracing; the invalid, too, desirous of a sheltered locality, can procure it at Low Harrowgate. But Harrowgate is not adapted in general for pulmonary complaints. As might be supposed, it rains often, but this in itself is not unhealthy, provided the invalid takes proper precautions. The Knaresborough district, in which Harrowgate is included, does not stand very high in regard to health, but this extends to the town district of Knaresborough.

The visitor at Harrowgate need have no want of pleasant recreations, for few districts in England abound more in picturesque sites and remarkable places than that which surrounds Harrowgate. Close to is Knaresborough, with its dropping fountain, a walk to which well rewards the visitor, not merely on account of the well itself,* but the road to it along a noble avenue by the side of the Nidd. On the opposite bank of the river are several caves, one of which had been enlarged by a hermit, concerning whom there are several legends. From the form of a cross on the inside of the cave, he may have been a crusader, and attached to one of the great military orders of the Hospital or Temple. Another cave is remarkable for the well-known murder committed there by Eugene Aram, the sum of whose defence, after all, consisted in telling the jury—"Many an innocent man has been hanged, therefore don't hang me, or I shall turn out to be innocent." Such is the pleading of some pretenders, who almost always quote Galileo, Harvey, and so forth, and argue that as their great truths met with opposition, so their own false science, being opposed, must be true. On the top of the cliff are the stupendous remains of the old castle of Knaresborough, truly a splendid ruin. The castle was demolished, or at least reduced to nearly its present state by the Parliament, on account of its gallant defence against their forces. Then, and not till then, was the power of the Norman fairly broken in England, and the triumph of the Saxon was signalized by the destruction of so many of the feudal fortresses which the Norman tyranny had erected in the land.

---

* As if a Frenchman could never by chance write about England without some absurd mistake, M. James is kind enough to inform us—"Comme les coutumes Britanniques ont un cachet d'originalité que vous retrouverez dans tout et partout, c'est en hiver, et non en été qu'on mit d'habitude la cure des eaux en Angleterre !"—*Guide Pratique*, p. 518. Well may he add a note of admiration. One is inclined to add two more to this piece of astounding information.

Then there are the singular rocks of Brimham, and Ripon with its cathedral and bone crypt. At hand is the Observatory, whence, by means of telescopes, fine views can be had of the vast expanse of territory surrounding the table land of Harrowgate. In the forenoon there are concerts in the Montpellier rooms. Balls are frequent; books are to be had at circulating libraries; the hotels afford every reasonable accommodation, while some of them are luxurious in the extreme. Nothing is wanting to make Harrowgate the perfection of an English spa, and most important of all there is no *humbug* about its waters. There is no occasion to talk respecting the Harrowgate waters, of the advantage of presenting their contents in a state of minute division and excessive dilution, which "renders them more easily assimilable and taken up by the capillaries." A kind of cant phraseology this on the part of writers on mineral waters indulged in by almost all, and which reminds one of the lines in the play—

---

* The petrifying ingredients are the carbonate and sulphate of lime.

"My wound is great because it is so small."

And the rejoinder of the Duke of Buckingham—

"Then 'twould be greater were it none at all."

---

## MINOR SPAS IN THE NORTH OF ENGLAND (YORKSHIRE).

Such is the well-deserved reputation of some mineral waters, and the confidence felt in the powers of this kind of natural medicine, that there is a tendency, wherever a water differs at all from the ordinary, to ascribe to it medicinal powers. Doubtless something of ancient superstition is connected with this. There is reason to believe that many of the so-called holy wells derive their reputation from the time of the Druids, with whom veneration for natural objects was a part of religion.

The belief in the powers of waters is deeply fixed in the minds of the mass of the people,—"and all the holy wells in the country, which the people still adorn at some stated times of the year with green boughs and flowers, in grateful memory of the good they have formerly done."—*Plot's History of Staffordshire.*

There is such utter ignorance as to what should, and what should not give a medicinal character to a mineral water, and medical men often have such loose ideas on the subject that what with this ignorance and the popular feeling,* numbers of waters have been exalted in various localities to the dignity of a spa which have very poor pretensions to that honour. It may be well, therefore, to refer to these pretended spas, or waters possessed of some feeble properties, were it only by way of contrast and example, to show what should, and what should not, entitle a water to be ranked among those possessed of medicinal properties.

I shall take them from Dr. Granville's book, in whose table some of them figure.

ALDFIELD Spa is found in a sequestered valley called Spa Gill, about a mile from Fountain's Abbey. Lord de Grey has permitted a room in an adjoining cottage to be fitted up with the necessary conveniences for either a warm or a cold bath. The water flows from a well rudely covered over, and sheltered except in front. Dr. Granville says the water is one of "pleasing freshness, though rather soft. It is almost wholly free from the peculiar flavour of strong saline waters, and the smell and taste of the sulphuretted gas present are akin to those of the mildest of the Harrowgate waters." In plain terms, the water is pure water, with a slight impregnation of sulphuretted hydrogen, of which waters there are abundance in the north; and the analysis, which absolutely gives it more sulphuretted hydrogen than Harrowgate, appended to Dr. Granville's work, is worthless.

---

* I cannot help relating the following anecdote. In the autumn of 1841 a water was discovered in a deep dene or dell called Jesmond Dene, near Newcastle, which had a slightly sulphurous taste, and which in a most extraordinary manner acquired all at once a prodigious reputation. My attention being directed to the matter, I repaired to the spot, encountering on the road numbers of people bearing pots, pans, bottles, *almost* every imaginable description of utensil filled with the salutiferous fluid. On reaching the place I found a crowd of some hundreds pushing and striving which should be first to drink. Stalls were erected near, as at a fair. Respectable people partook of the mania, and none of the medical men dared oppose it. I found that the water was oozing at the rate of a gallon a minute from a bank about a foot above the level of a brook, while another brook, which in point of fact was only a drain receiving all kinds of abominations, descended precipitously across the edges of strata of bituminous shale at one side of the spa into the main brook. I came to the conclusion that infiltrations through the shale from this source might be the cause of the virtues of the "spa," and having made a slight examination, and satisfied myself that at any rate the water was worthless, I wrote a quiz on the whole affair. The spa-goers, however, were not to be deprived of their belief so easily, and I was most savagely abused in the local papers. I then published a minute analysis, showing the utter absurdity of the affair. Still this was not enough; a committee was appointed to investigate the matter. These worthy souls commenced where they should have ended, viz., by publishing a list of cures effected by the "spa," among which I recollect was one of "stoppage of the windpipe." However, they did one wise thing; they stopped the pipe by which the drain might reach the spa, and from that time till some heavy rains forced a passage, not a drop of water passed through the pipe which they had put in. This was too much even for the spa-goers. The place is quite deserted. Nevertheless one cannot affront public opinion with impunity; and a friend of mine was told years after that the spa had gone down, notwithstanding all Dr. G.'s attempts to puff it off. Nor could my friend convince the other.

Hovingham.—Respecting this water, Dr. Granville says "that neither from its locality, nor, indeed, from its quantity, is it likely ever to become a favourite." Two baths were near the spa in a wooden hut. It tastes like all mild sulphuretted water, and contains, according to Dr. Travis, of Malton, five grains of solid matters in the sixteen ounces, containing only what many potable but rather hard waters do; for the five grains consisted, according to Dr. Travis, of sulphate of magnesia and muriate of soda. "But," says Dr. Granville, "the water is used by the common people of the neighbourhood both to drink and bathe in cold." The bathing is all very well in itself, and may, doubtless, do good, but Dr. Granville goes on to say gravely—"That such a water, notwithstanding the simplicity of its composition, possesses properties which recommend it to the attention of medical men, I have the authority of Dr. Simpson, of York, of Mr. Dawson, of Hemsley, and of Mr. Wilcocks himself, for asserting; and, indeed, it is a fact to be deduced physically from its composition." This is really too bad. We then have a list of diseases in which it has proved beneficial. However, it appears that the good people of Hovingham drink it "as their common beverage." And well may they do so, if, as Mr. West says in his report, instead of containing sulphate of magnesia and muriate of soda, it contains thirty-eight grains of carbonate of soda with three grains of muriate of soda in the gallon, and not a trace of sulphates. It is, therefore, a very soft water, and no doubt makes excellent tea. We should like to see any one put the waters of Harrowgate to such a test. Nevertheless, as Mr. West observes of another sodaic water near Leeds, named Holbeck water, of a composition similar to Hovingham, it might be well to investigate the effects of such waters used habitually on health. Holbeck water, too, is much sought after for culinary purposes.

### THORPE ARCH.

This "spa" is situated close by the margin of the Wharfe, near to the ancient town of Wetherby. Baths, hot and cold, and shower baths, are given. The place is most delightfully situated, and fishing, Dr. Granville says, can be procured. I *know* that boating can be had on the river Wharfe, and an angler was fishing in the river when I was there, and regret—in return for a pleasant day spent there with two brothers then practising in the vicinity, one of whom a few weeks after received an appointment in South America, and died of fever within two days of his arrival, and the other of whom is now wandering somewhere in America—that I cannot give the "spa" a higher character. It has the reputation of curing a vast number of diseases, and is in point of fact a strong saline water, of which there is indeed no want in England. The following is its composition, according to Mr. West:*—

| | Grains. |
|---|---|
| Chloride of sodium | 822·0 |
| Chloride of calcium | 59·0 |
| Chloride of magnesium | 11·5 |
| Silica | 1·25 |
| Carbonate of iron | 1·75 |
| Total | 895·5 in the gallon. |

That such a water may produce medicinal effects is certain. Had it been thermal, or possessed much carbonic acid or sulphuretted hydrogen, it would have been very valuable. The erection of baths at such a point is very laudable, especially as Wetherby is at such a distance from the sea.

---

* Report on the Yorkshire Waters.

### NEW MALTON SPA.

Unless a late analysis of this water has been made, there is no precise one of it. It is apparently a pretty strong saline chalybeate. A pavilion is erected by Earl Fitzwilliam, according to Dr. Granville. It has, according to Dr. Short, the same ingredients as Scarborough, and probably the same operation, neither of which seems unlikely. He mentions also Stenfield, "discovered forty years ago through a man having sunk a well in a puddle-hole before his door, where swine used to lie and wallow. As soon as the well was finished, he brewed with it, and found it a safe and pleasant beverage, and so the country people frequented it."

### ASKERNE.

This water has long engaged attention, and apparently with considerable reason. Dr. Granville, quoting Mr. West, gives it 17·09 grains of solids to the imperial pint, or 136·72 to the gallon, with 0·9 of a cubic inch of sulphuretted hydrogen, or 7·2 to the gallon.

There are several sets of baths belonging to various proprietors, and suitable places for accommodation and residence, and the proximity of Doncaster and the populousness of its neighbourhood ought to secure some attention to Askerne. Mr. West says, in his report on the Yorkshire waters, "I analysed several of the springs about five years since." (This is in 1844, and the date of his analysis in Dr. Granville's table is 1840, so that, at any rate, if correctly rendered, it does not adequately represent Mr. West's views of the composition of these waters.)*

---

* Mr. West died shortly after I met him, on the other side, at a chemical trial at York, in 1848. I had hoped his son—a former pupil—might have enabled me to clear up some points from his father's papers; but he could furnish me only with the published accounts. No man of his day had so much to do with English waters as the late Mr. West.

"The waters of Askerne, near Doncaster, have long enjoyed some celebrity, and several sets of baths exist there. I analysed several of the springs about five years ago. I found in the old Manor House Bath :—

| | Grains in Imperial Gallon. |
|---|---|
| Sulphate of magnesia ............ | 153·18 |
| Sulphate of soda .................. | 58·06 |
| Chloride of calcium............... | 82·83 |
| Carbonate of lime .............. | 12·05 |
| Carbonate of soda .............. | 30·19 |
| Total .............. | 236·31 |

| | Cubic Inches. |
|---|---|
| With Sulphuretted hydrogen ......... | 8 |
| Carbonic acid .............. ...... | 5¼ |
| Nitrogen .......................... | 8 |
| Total .............. | 21¼ |

Three other springs, supplying the baths of various proprietors, were so nearly alike in their results that one statement may be sufficient—

| | Grains in Imperial Gallon. |
|---|---|
| Sulphate of magnesia ............ | 17·75 |
| Chloride of calcium............... | 3·90 |
| Sulphate of lime .................. | 103·80 |
| Carbonate of lime .............. | 12·20 |
| Carbonate of soda .............. | 26·35 |
| Total ............... | 164·0 |

| | Cubic Inches. |
|---|---|
| With Sulphuretted hydrogen......... | 6½ |
| Carbonic acid...................... | 8¾ |
| Nitrogen .. ...................... | 11 |
| Total ........... ... | 26¼" |

These results appear sufficient to render this old water by no means despicable; and, indeed, it is probable that a more modern analysis might bring to light a still more valuable constitution. Of course the waters are recommended in all cases where sulphur waters are used. There seems no reason at least why they should not be used in all those cases where the milder Harrowgate waters are recommended. In some respects these waters, especially the first of the two here given, have advantages over Harrowgate, since they contain sulphates, and the first a not very small proportion of sulphate of magnesia.

According to Dr. Dean, the old writer already mentioned, the Askerne waters were found very useful "by the farmers in curing chafed horses, or oxen galled by the yoke, mangy dogs, scabbed horses, etc." The lines of Dr. Chorley, a physician who practised at Doncaster in former times, have been often quoted, yet there is an oddity about them which renders it difficult to refrain from the temptation—

> "The devil, in passing by Askeron,
> Was asked what he thought thereon;
> Quoth Satan, judging by the stink,
> I cannot be far from home, I think."

HORLEY GREEN Spa, much praised by Dr. Granville, is one of those strong chalybeates which abound in the North of England. The iron salt present in them is almost always the sulphate, very often with alumina. The very water that runs from the pits and mines would furnish such a spring as Horley in many instances. Such waters will never be popular as mineral waters, because people feel that they would only take what they could get in a druggist's shop in a much pleasanter form. It is the same with the brine springs. One of the best of the copperas springs exists on the banks of the beautiful Coquet, in one of the healthiest places in the world, near the town of Rothbury, in Northumberland. People *can* drink it, and it has effected cures. There can be no doubt of the power of those springs, but they will never be looked on as spas.

The baths at Slaithwaite are supplied by a mild, soft, slightly sulphuretted spring. Ilkley is a pure, cold mountain fountain, now supplying a hydropathic establishment under the more attractive and more mysterious name of Ben Rhydding. Under its old title, in the opinion of the people of Yorkshire, it did not disgrace the virtues of simple cold water, externally and internally applied.

### HYDROPATHY.

This may be considered a suitable place to say a few words on this topic. There were three waters in England, if not more, which enjoyed the reputation of spas, under very slender real claims—Ilkley, Matlock, and Malvern. Almost the only pretension which could be set up was for Matlock, on account of its temperature, 68°. Ilkley contains hardly six grains of salts in the gallon, and Malvern only eight grains; nor is there anything in the nature of the salts to account for any medicinal effects. Malvern, nevertheless, has been said to produce such effects. Those waters are admirably adapted for the purposes, as their positions for the sites, of hydropathic establishments, and to this purpose have they been applied.

The merit of Priessnitz and his followers, if merit it be, consists not certainly in the application of cold water in the treatment of disease, either externally or internally. Innumerable treatises have been written on the various forms of cold bathing—the cold affusion in fevers and gout; and even on the merits of cold water itself taken internally in large quantities as a medicinal agent. We have seen, in point of fact, from the experiments of Böcker, that cold water taken to excess does not merely increase the quantity of fluid excreted by the skin and kidneys, but that this fluid carries with it a certain proportion of solid matter, and so accelerates the metamorphosis of the tissues. Thus we find the following :—"Water taken in very large quantity, as a glassful every quarter of an hour, is recommended by Cadet de Vaux as a remedy against gout." "Of all the emollient drinks," says M. Gerard, "water is beyond contradiction the most common and efficacious."* What we owe to Priessnitz is the mode of application—the wet sheet—and the extent to which the system is carried both in its mode and the diseases to which it is applied. It has also been long known that the sudden transition from a hot or vapour bath to cold is not so dangerous as was supposed,—exemplified in the practice of the Russians leaving their vapour baths and rolling themselves in the snow. And it has been long known that in cold bathing it is better to enter the water when the body is moderately warm than to wait until it is cooled by the air; the reason, doubtless, being that in the former case it is more capable of that reaction after the plunge to which the benefits of the cold bath are so much owing.

---

* Bayle, *Dictionnaire de Médecine*, Art. "Eaux."

When the body, except the head, is wrapped in a wet sheet, and that enveloped in a dry wrapper, the first effect is extreme cold and shivering; but in the course of perhaps half an hour this is followed by a sensation of heat, which in an hour becomes burning, while the face flushes. Generally in an hour and a half profuse perspiration bursts forth, and in two hours this is excessive; the general practice then is to take a cold plunge bath, and to remain there a very short time—say a minute. This is followed by frictions, and the effect is to produce a strong glow of the skin, free respiration and disposition to exercise, which indulged brings back moisture, if not perspiration, to the skin. After a couple of hours of exercise, the body in some practices is again wrapped in a wet sheet, which, after a few minutes' friction, is exchanged for a dry cloth, and exercise is again practised. An hour after this the douche, or shower bath, is often used. If this practice be begun at six A.M., dinner may be served at one. The patients generally have good appetites: nothing should be drunk but water. After some hours of repose or amusement, say at five P.M., a sitting bath may be taken. This may be formed by the crossing of a number of small jets set in motion at the turn of a stop-cock; the surface exposed to the currents is well rubbed during the duration of the bath, which may be for a quarter of an hour or twenty minutes. The skin exposed to the action of the water is reddened. This bath is followed by frictions. Finally, in the course of an hour or two and after exercise, a foot-bath of cold water again may be taken. A frugal supper completes the day.

Various modifications, according to the disease treated—frictions, large draughts of cold water, exercise, abstinence from stimulating drinks, plain diet; that is the system called hydropathic. In some respects one might imagine oneself transferred to the gymnasia, where in ancient times disease was treated on an analogous isolated system.

The power of such methods, taken along with the pure air and healthy localities in which hydropathic sanatoria are generally seated, to cure many forms of chronic disease, and especially functional disorders, cannot be doubted. The continuance of the treatment produces effects resembling in many respects those of mineral waters—a state of febrile excitement like the *bad-sturm* of the Germans, often resulting in cutaneous eruptions, vesicular, pimply, or even pustular, and copious perspirations and other evacuations. This crisis, like the *bad-sturm*, is often preceded by sleeplessness, lowness of spirits, restlessness, excited pulse, dry skin, and apparent aggravation of the symptoms of the original disease.

Among the diseases in which hydropathy is most calculated to be of use may be enumerated, in the first place, chronic rheumatism and gout, diseases depending emphatically on a depraved state of the humours. Here the stimulation of the skin, the alterative effect of the evacuations, and the dilution of the blood by large doses of the waters, the local application of douches to the parts especially affected, conjoined with the regimen, have a fair field of action. It is in this class of affections, perhaps, that hydropathy has had most success. But where there are diseases of the heart or great vessels, where there are what are called atheromatous deposits—a kind of earthy formations in the coats of the arteries, weakening them by destroying their elasticity, and rendering them liable to a sudden rupture—can these be cases for the employment of so powerful a remedy? And how difficult it is often to judge whether such a state of things exists or not? In all absolutely organic diseases, acute inflammatory affections, or cases where there is a tendency to sudden transference of the disease from the circumference of the system to the centre, hydropathy, common sense would seem to teach, must be a dangerous remedy; and where actual organic lesion exists, it is difficult to see how it can do good. We cannot in this way expect to procure absorption of really effused morbific matter, as by such remedies as iodine and mercury—remedies, too, which admit of being proportioned to the disease and constitution without danger of a sudden and calamitous result.

In internal congestive affections, the derivation of the blood to the surface, and the evacuations produced, may be alike beneficial. The frictions are especially likely to be useful, and the ingestion of cold water in thinning the blood.

In the dyspepsia of men of the world, who have lived freely, whose minds are fatigued with mental efforts, and perhaps a good deal satiated with pleasure—*blasé*, as the phrase is—but who still retain a residue of mental energy, the hydropathic treatment has wrought wonders, as some of them have done us the favour to tell us.

In skin diseases there seems often a proper field for the use of hydropathy, also in anomalous nervous affections and in hysteria. Although we fancy a weak nervous woman should only undergo the treatment in a very modified form, still, from the artificial life of fashion, which often in women encourages a host of capricious complaints, we can imagine a change such as a few weeks of hydropathic treatment, might do good, even if the transition were a little rude.

In paralytic affections and neuralgia, where the great centres of the nervous system are uninjured, and in spinal debility produced by excess, unquestionably great benefit has been derived, especially by douches and sitting baths. In eruptive diseases and fevers the danger is obvious; nevertheless, it has been incurred with at least less evil effects than could have been anticipated. In some diseases peculiar to the sex, it is not easy to see how hydropathy can be beneficial, except by improving the general health—and sea-bathing seems more likely to attain this result. The same may be said of scrofula, and a host of diseases, for which the invalid who applied to a hydropathic establishment would most certainly be subjected to the usual course.

This, indeed, is the great objection to such institutions—the exclusive nature of the system enforced, and universal application of it. As a mode of treatment in suitable cases, assisted by proper medicine, not only may hydropathy do much good, but it may be pronounced a very great addition to the resources of medicine. The excessive extent to which many medical men, especially in England, carried the drug system, and the empirical mode in which they practised it, deserved the reprimand which such a system has of late received from this and other innovations.

According to Dr. Johnson, cases of carbuncle have occurred from over-excitement of the skin by the hydropathic treatment. Dr. James quotes the remarkable passage in the life of Alexander, when he was nearly killed by bathing, when heated, in the Cydnus, as an illustration of the possible dangers of hydropathy. "I borrow," says he, "from Quintus Curtius, the following recital:—'It was in the middle of one of the hottest days of a burning summer that Alexander arrived on the banks of the Cydnus. The freshness and clearness of the water invited the king, covered with sweat and dust, to take a bath; he stripped himself of his clothes, and his body all in a sweat, he descended into the river. Hardly had he entered, when his limbs became suddenly stiff, the body pale, and vital heat seemed by degrees to abandon him. His officers received him almost expiring in their arms, and carried him senseless into his tent.' Here the circulation stopped in the capillary vessels, and became concentrated on the heart and great vessels, stagnating there and in the lungs. 'At the end of some time he began to respire more fully, lifted his eyes, and recognised his friends.'

Then began the symptoms of febrile reaction, which his physician, following the precepts of the Hippocratic school, allowed to continue till the third critical day, when he gave him a powerful stimulating potion, employed hot fomentations, and caused his patient to inhale the fumes of wine."*

Of all modern systems of bathing, the Turkish seems to be best adapted to the climate and habits of the people. It is less, in fact, what we term bathing than cleansing thoroughly. There is not a bath, in our sense of the word, in the whole process, as generally employed. The traveller who may be allowed to visit the splendid bath-rooms of stalactitic marble in the Sultan's new palace of Dolma Bagtche, will find basins instead of what we term baths.

In the general Turkish baths the first apartment corresponds to the *frigidarium* of the Romans. There is a large hall, generally circular, or polygonal, lighted by a dome, underneath which is a basin of water with a fountain. Here the bather deposits his clothes, and puts on towels, and pattens, with which to tread on the marble floor. He is then conducted into another apartment of moderate heat, the *tepidarium,* calculated to create a gentle perspiration, where he is shampooed. He then enters an apartment filled with vapour, the *sudatorium,* where he undergoes a profuse perspiration, and is rubbed while in this state and sluiced with hot water, until the effete epidermis is rubbed off in prodigious quantities. He then is washed freely with soap and water, and dried, and conducted to an apartment, where he is served with coffee and a pipe, and left to repose in a state of ecstatic beatitude, the perfect impersonation of what the Turks call *keif;* a word which, like our *comfort,* has no equivalent, and which, perhaps, can nowhere be enjoyed in such perfection as in that climate, in sight of the ever-moving panorama of the Bosphorus, just as an English traveller feels that nowhere can comfort be obtained as at *home.* Alas, how often has the invalid been taught too sadly the lesson!

---

* A similar feat proved fatal to Frederick Barbarossa at the very same stream.

# CHAPTER VI.

Buxton an elegant Spa.—The only Mountain Spa in England.—Effect of Elevation.—Erroneous Opinion formerly held with regard to the Non-variation of the chief constituents of the Air.—Cases in which an elevated Site may be injurious.—History of Buxton.—The Romans. —Its fame during the time of Queen Elizabeth.—Visited by Queen Mary.—Shut up at the Reformation.—Its Votive Offerings of Crutches, &c.—Analyses of the Water by Sir Charles Scudamore and Dr. Playfair.—Attempts to explain its Operation by the presence of Nitrogen.—Buxton Chalybeate.—Supposed Volcanic Origin of Buxton Water.—Properties and Uses of the Water.—Climate of Buxton.—Matlock.

## BUXTON.

If spas are to be decorated with titles of nobility, it may be doubted at the present day whether the first rank should not be assigned to Buxton. When a mineral water is prescribed as a remedy, it must ever be borne in mind that not the water alone is in question, but the adjuvants, the healthiness of the locality, the air, the scenery, the various accompanying circumstances which are likely to contribute, not merely to the ease and comfort, but the healthy recreation of the patient. Just as a physician adds to his prescription what will make the active and essential parts of it easily borne by the stomach, or correct in it what is likely to be disagreeable to the senses, so there are the *adjuvantia*, to use the technical term, of the mineral water as the basis. In all these respects Buxton stands pre-eminent. The baths are now unrivalled in splendour. The most fastidious cannot complain of the want of comfort or even luxury; handsome grounds laid out by Sir J. Paxton to the extent of 100 acres are ready for recreative walks on the spot; and for more extensive excursions the visitor is surrounded by the Peak and its wonders, and the varied mountain scenery of Derbyshire.*

Buxton is the only one of our spas of consequence which partakes of a mountain character, while on the Continent they are to be found at the height of several thousand feet above the sea ; but Buxton has an elevation of 1000 feet, while some of the surrounding hills rise to the height of 2000 feet. The effect of elevation is almost always expressed by the term "purity of air." No doubt the air is purer, more salubrious, and fitter for the due performance of the respiratory functions than in the confined streets of towns. It was at one time thought that no difference in the proportions of the ordinary constituent elements of the atmosphere could be discovered in different localities, but it is now ascertained that where large masses of human beings assemble, there is great increase of the amount of carbonic acid. Independent of this, the recent discovery of ozone, and facts known already to exist with regard to its influence on health, show that more subtle elements are to be looked for than the mere ordinary constituents of our atmosphere, the carbonic acid, oxygen, and azote. Where large masses of men assemble, in the dark or dingy streets of cities, or in factories, ay, or in crowded ball-rooms, notwithstanding the array of fashion that may be present, doubtless miasmata arise. It is possible for a person who has resided some time amid the mountain air, on returning to a crowded manufacturing town, almost to *taste* the air. But that principle, ozone, whose influence there is reason to believe is so great, is found more developed in elevated situations. In such situations, from the diminution of atmospheric pressure, greater efforts of the respiratory muscles become necessary to draw the air into the lungs;[*] while, at the same time, from the removal of the usual resistance, the heart propels the blood with more force. Thus, at very great heights, the blood gushes from the nose and mouth. Hence elevated situations are unfavourable to persons who have a tendency to spitting of blood, lest the increased force of the heart should break through the weakened pulmonary tissue.

---

* There is so much of a practical nature to discuss with regard to Buxton, that I must refer at once to the very excellent "Hand-book to the Peak of Derbyshire," and the "Use of the Buxton Mineral Waters," by Dr. Robertson. It is a model for books of the kind. I cannot refrain, however, from one or two points connected with the history of Buxton, before plunging *in medias res.*

At Buxton the Romans, to quote Sir Francis Head's expression again, showed their keen scent for mineral waters. But is it not probable, as was clearly the case in Gaul, that they found these places already frequented by the natives? The writer's idea that these waters were, in many instances, known to the Druids, and that the custom of decorating the holy wells at particular times of the year with green boughs and flowers was more ancient than even Roman Catholic times, has been stated. Although the reader will find the quotation in Dr. Robertson's Guide-book, I cannot help quoting the following from Dr. Short:—"For it is certain that as to priority of use or writings, the Bath in Somersetshire, and Buxton, in Derbyshire, challenge the precedency of the whole mineral waters of England; the last without all dispute having been as well known to the Romans as the former, which is evident, first, from the remains of the ancient Roman-brick wall about St. Anne's Well, which was totally razed in 1709, when Sir Thomas Delver, of Cheshire, erected the present beautiful arch over that noble tepid fountain. Secondly, about thirty-six years ago, when Mr. White, then of Buxton Hall, was driving up a level to the Bath, fifty yards east of St. Anne's Well, and fourteen yards north of Bingham spring, the workmen found buried, deep under the grass and even mould, sheets of lead spread upon great beams of timber, about four yards square, with broken ledges round about, which had been a leaden cistern, and not unlikely that of the Romans, or some other ancient Bath, which had been supplied with water from Bingham Well." His third reason is the proximity of Roman roads and camps. Of its repute in what are termed the dark ages, he instances the foundation of the chapel of St. Anne, under whose protection the well was supposed to be.

---

[*] The writer recollects that after an ascent of the Brevent performed in three hours, and some more fatiguing mountain work, on retiring to rest he had almost the sensation as if his breathing was muscular. Sir J. Forbes says he ascended in four hours.

Such was the fame of Buxton during the time of Queen Elizabeth, that a petition was sent to Parliament by the people of Fairfield, praying for a grant to support a minister or chaplain, as they had fallen into extreme poverty by reason of the frequent appeals of divers poor, sick, and impotent persons flocking to the fountain of Buxton. Two years after, anno reg. Eliz. 29, an act was passed that none resorting to Buxton Well should beg, but should have relief from their parishes, and pass under the hands of two justices of the peace, fixing the time of their return; nor were they to beg there, under pain of incurring the penalties of that act. Yet before this, at the Reformation, the well had been locked up, and the crutches, shirts, and other things of the kind left as votive offerings at the chapel of St. Anne, removed by Sir William Bassett, a letter from whom to Lord Cromwell relates what he had done to put a stop, of course to what was regarded as the superstition of the people. The authorities, however, must have soon relented, as, independent of the fact above mentioned, the Earl of Shrewsbury visited the place several times with Queen Mary, and built a well there.

There must have been two removals of crutches, for Dr. Short says—" When the old Earl of Shrewsbury's building was demolished, about sixty years ago, and a new edifice erected by the then Earl of Devonshire, this Bath suffered two irreparable losses of its greatest ornaments, viz., the registers wherein were written and preserved for some hundreds of years an account of the most remarkable cures, whether inward or outward, put down and signed by the eased or cured patient, and written by the attending physician, or, in his absence, by the bath-keeper, and subscribed by the person's own hand . . . . The other noble and beautiful pieces of furniture lost were the many rows of crutches left hanging in two large rooms, as the lasting monuments of the happy delivery of so many lame, halting, pained and tortured wretches by the use of this bountiful largess of heaven."

Buxton water flows from several crevices in the limestone rock, to which different names have been given, and which, uniform in composition, are united in the baths. Great improvements have been made of late years, both as regards the baths themselves and the supply of water, which is now all that can be desired.

The analyses of Buxton water have furnished much matter for speculation. The first analysis was made by Dr. John Jones, who lived at King's Mede, near Derby, and wrote on Buxton, 1572. He made the pint of Buxton water contain fifty-eight grains of solids, whereas the water does not contain half as much in the gallon. The succession of analyses of this water offers an illustration of the progress of chemistry in this respect down to the recent elaborate analyses by Professor Lyon Playfair. But analysis or no analysis, whether anything was found to account for the medicinal effects or not, the popular belief in the effects of Buxton water has remained unshaken. In Dr. Robertson's little work will be found some of the older analyses. It will be sufficient for the purpose if the analysis of Professor Playfair be contrasted with that of Sir Charles Scudamore; for on the contrast rests matter of curious speculation.

Sir Charles Scudamore, in a wine gallon, 1820:—

| | Cubic Inches. |
|---|---|
| Carbonic Acid .................... | 1·50 |
| Nitrogen (azote) .................. | 4·64 |
| | 6·14 |

| | Grains. |
|---|---|
| Chloride of Magnesium | 0·58 |
| Chloride of Sodium | 2·54 |
| Sulphate of Lime | 0·60 |
| Carbonate of Lime | 10·40 |
| Extractive and Vegetable matter | 0·50 |
| Loss | 0·52 |
| | 15·14 |

Dr. Lyon Playfair's (1854) analysis: Temperature, 82; specific gravity, 1000·3. In a gallon at 60°:—

| | Grains. |
|---|---|
| Silica | 1·666 |
| Oxide of Iron and Alumina | 0·240 |
| Carbonate of Lime | 7·773 |
| Sulphate of Lime | 2·323 |
| Carbonate of Magnesia | 4·543 |
| Chloride of Magnesium | 1·117 |
| Chloride of Sodium | 2·420 |
| Chloride of Potassium | 2·500 |
| Fluorine as Fluoride of Calcium | trace |
| Phosphoric Acid as Phosphate of Lime | trace |
| Total | 20·579* |

Carbonic Acid—Free, in weight......7·402 grains.
Gases, Nitrogen ... 200 cubic inches.
,, Carbonic Acid 15·66 ,,

The mode in which Dr. Playfair proceeded was this: for the solids he boiled down no less than 100 gallons of the water, and experimented on the residuum; for the gases he collected them by holding inverted bottles filled with the mineral water itself over the crevices whence the water was flowing. In this way, then, whatever gas was escaping from the crevices, along with the water, was added to the gases already existing in the mineral water. By the method which Dr. Playfair very properly pursued of operating upon quantities of water, in this country at least unprecedentedly large, he was enabled to detect substances which had hitherto escaped observation, as well as by means of a more refined analysis in his able hands. But the probability is, that there are few spring waters in Derbyshire treated in the same manner which would not have yielded similar results in the hands of an able chemist.

---

* The absolute quantities of solids in the two analyses do not differ materially, taking into consideration the difference between the wine gallon and imperial gallon.

Of course this discovery of the existence of so large a quantity of nitrogen in Buxton water, or accompanying it, led at once to the conclusion that the desideratum was found, the problem solved, and the mysterious effects of the water explained. Dr. Robertson, who had long entertained a very high, and no doubt sincere, and probably in many instances correct opinion of the virtues of the water, was of this opinion. In his work he argues of the fundamental importance of nitrogen in the frame, the essential tissues, or at least the more vital tissues, being principally composed of it, consequently the more important part of our food being also composed of it, and so forth. Wildbad, in Germany, whose wonderful properties have long been as much a mystery as those of Buxton, contained, it was discovered, actually eighty per cent. of its volume of azote, and Gastein, another of these mysterious waters, two and a half per cent. of its volume, while Pyrmont contains nearly twice its volume of carbonic acid gas! But between nitrogen and carbonic acid there is this important difference, that whereas the former is one of the gases *least* soluble in water, the other, if not among the most soluble, is at least very soluble. Water will absorb and retain rather more than its volume of carbonic acid, while it can, with the greatest difficulty, be made to absorb and retain three per cent. of its volume of oxygen, and even less than that quantity of nitrogen.

Of the quantity of nitrogen then discharged along with the water, how much reaches the bather? Sir C. Scudamore's analysis, taking the water such as it actually is when it is drunk, when the means of separating carbonic acid and azote, the only gases in the water, were as perfect as they are now, gives a very small quantity of the latter. Does the fact of some bubbles of nitrogen gas bursting near the bather account for the properties of Buxton water ?* Here it may be observed—

1st. Of all gases nitrogen has hitherto been considered the most inert. The very fact that the atmosphere consists of four-fifths of it, where its only function, as all experiments tend to show, consists in diluting the oxygen, would seem to lead to this conclusion.

2nd. Experiments on animals have led all investigators to the same point.

3rd. Those gases to which great effects have been ascribed in the action of mineral waters, as carbonic acid and sulphuretted hydrogen, exert unmistakeable power of action on the human frame : air containing thirteen per cent. of carbonic acid is capable of producing fatal effects; the $\frac{1}{240}$th part of sulphuretted hydrogen in air will kill a horse. A current of carbonic acid excites itching and tingling of the skin; and when inhaled in an approximation to purity, its action on the delicate, sensible membrane of the entrance to the windpipe, and through it on the nervous system, is such that the glottis, as it is called, is closed, and the individual inhaling the gas is strangled. Even accidents have happened to the attendants of mineral sources where this gas is disengaged in quantity. Nothing of the kind exists with regard to nitrogen. The fact of its forming so large a portion of the body is of no moment: the question is, as to its operation in the form of gas. If, indeed, it were drunk in quantity there might be less reason for surprise, because a substance innocuous when applied in one form to the body, or to any particular organ, may be very active when applied in another form or to another organ; but if any large quantity of this gas exists in Buxton water as drunk, how is it that it had hitherto escaped detection ? A man so experienced in the analysis of mineral water as Sir Charles Scudamore would surely not neglect the usual precautions of carefully collecting and sealing up the water; and in the age of Berzelius and Davy, it is not likely that a well-educated chemist like Sir Charles Scudamore could be ignorant of so simple a matter as the mode of separating carbonic acid and azote.

---

* Dr. Granville says—"Bubbles of air may be seen rising in succession from time to time. At other times a single one much larger than the rest will come up to break at the surface" (of the bath).

Dr. Robertson, in speaking of the physical characters of the Buxton waters, describes their brilliancy when drawn; that they have a slight bluish shade; the brilliancy he ascribes to the quantity of gas "held in solution."* On holding a bottle filled with the water between the eye and the light, a number of small bubbles may be observed (the same may be said of many waters). "In the natural baths these are given off in bursts." Water will hold hardly any nitrogen in solution. What occurs in the baths, where a quantity of the nitrogen has been hurried along by the current of water, furnishes no indication of the quantity of the gas in solution. The fact, therefore, that when Buxton water issues from the rock more than two-thirds of its volume of nitrogen bursts out with it—for that seems to be the true state of the case—I venture respectfully to suggest, on all these grounds, is no sufficient reason for attributing the properties of Buxton water to the presence of this gas, in the midst of which we live and move. As for the two and a half per cent. of Gastein, the very notion merely shows how loose and inaccurate the views maintained with regard to the action of mineral waters sometimes are. If Gastein owed its ascribed wonderful powers to *this cause*, we should have many Gasteins, since there are a great many springs in this country which contain more nitrogen than that. It seems, too, very absurd to ascribe the activity of Gastein to two per cent. of the same gas of which Wildbad contains eighty per cent.;* and again to suppose it the cause of the activity of Pfeffers, which contains still less. The probability is, that if a similar mode of proceeding to that adopted by Professor Playfair for collecting the gas were practised with regard to other springs, the presence of a large quantity of azote would cease to be an isolated fact. It ought not to be an uncommon gas, especially in mineral countries; since wherever oxidating processes are going on, nitrogen might be expected to be present, separated from atmospheric air by the withdrawal of the oxygen; but, as in the present instance, its detection in large quantities would be difficult on account of the very slight affinity of water for it, unless the gas were caught as it came up with the waters at their very source.

---

* It is amusing to quote the following from a very entertaining writer:—"I have my doubts as to the presence of what is called azote in mineral waters. Mr. West finds it everywhere. . . . . Other English chemists have also mentioned it, as I stated in the introduction. Strange that in none of the German waters I have studied the same principle should have been detected by the very eminent analysing chemists who performed the analyses. The water at Baden Baden is the only one"—(there are many others)—"that has been mentioned as containing azote in very minute proportions. But that statement is not made by a chemist of note, and is not to be relied upon."—*Spas of England: Midland Division:* vol. ii., p. 33.

For these various reasons, therefore, in the opinion of the writer, the properties of Buxton water must remain unexplained; and there remains only the coincidence of the existence of a large quantity of nitrogen gas, with the extraordinary medicinal properties of the water. Can the oxidating process, which in all probability disengages this azote, have to do with the thermal heat?

Buxton, too, does not want a chalybeate, of a very feeble character it is true, but about half as strong as Tunbridge, containing 7·082 grains of solids in the gallon, of which 1·044 is oxide of iron, and 1·160 silica. It issues from a narrow bed of shale between the limestone and gritstone.

Buxton is not an exception to that law which connects so many of the thermal springs with volcanic regions. Sir Henry de la Beche, quoted by Dr. Robertson, says—"In Derbyshire the observer will again see igneous rocks associated with ordinary deposits; in this case with limestone, known as the mountain or carboniferous limestone, in such a manner that their relative geological antiquity can be ascertained. Careful investigation shows that in that area at least, and probably much beyond it (beneath a covering of the sand, shales, and coals, known as the millstone grit and coal measures, and after a certain amount of the limestones had been accumulated), there had been an outburst and overflow of molten rock irregularly covering portions of them."

---

* It is not clear that this quantity of azote exists in Wildbad. One authority before me says that the chief gas which exists is atmospheric air.

To describe at length the new baths and their admirable arrangements would exceed the limits which can be here allotted to any one spa. Covered with a roof of glass, an elegant, spacious, and commodious building contains no less than five large swimming and plunge baths of the water at the natural temperature; ranges of private baths with douches, and of douche closets for the use of the douche within the baths. The gentlemen's public bath is twenty-six feet by eighteen; the ladies', twenty-three by eighteen; the private baths, eleven by five. The height of the gentlemen's public bath is four feet eight; of the ladies', four feet two; both with dressing-boxes. Men's charity bath is twenty feet by fifteen; the women's the same. There are hot baths where the water is used heated to the temperature of an ordinary hot bath, public and private, and charity.*

### WITH REGARD TO THE PROPERTIES OF THE WATER.

It is little used internally. Dr. Robertson says it sometimes produces giddiness, and this is partly confirmed by Dr. Granville. It acts somewhat on the kidneys.† Dr. Robertson recommends that the chalybeate should not be taken before breakfast; a precaution which, with due deference to his opinion, appears superfluous. It is not so on the Continent.

---

* The supply of water is 300 gallons per minute. Dr. Robertson enters into a calculation of the amount of nitrogen which will be thus supplied, which it is unnecessary to give.

† All water in quantity does.

The great use of Buxton water is of course externally. All parties agree that the baths at the natural temperature produce a shock at first. Dr. Granville says the same as in the open sea. He adds—"There is no disguising the fact, Buxton is a cold, and not a tepid, bath, and only becomes tepid to the feelings by a little management; as in the open sea, but not in an ordinary water-bath at 83°. The difference here is that the warmth when once felt is a permanent sensation, were you to remain even hours together in the bath; whereas, in ordinary water, tepid bathing, or the open sea, or in a river or a spring in the sun, the water which at first might seem tepid, would soon progressively feel colder and colder. This difference, which it is of the most vital importance to bear in mind in using mineral baths, is invariably to be observed in thermal springs, and is to be attributed (as I remarked elsewhere) to the peculiar nature of telluric or volcanic heat, as contradistinguished from the ordinary heat of our fires."

It surely is not necessary to go to telluric heat to account for so simple a matter. Buxton water being below the temperature of the body occasions a shock at first, but that overcome, the heat of the bath, although not sufficient to prevent a feeling of chilliness at first, is yet sufficient to prevent the body feeling cold when it has got accustomed to the water, which at 83° is a very different thing from the open sea.

Dr. Robertson says the shock felt on entering the baths sometimes continues the whole day, and even through the following night and great part of next day. When this is the case, he prefers the heated water as less excitant. Few who are incredulous as to the powers of the water remain incredulous after its use. Sometimes the use of the bath is followed by increase of feverishness, pain, or stiffness. This may last for from five to twelve hours after bathing, and if the baths are persevered in may end in the water fever, characterized by languor, feebleness, indisposition to make any exertion, want of appetite, lethargic sleep, etc. He says the best time for taking the baths for the effect is before breakfast, but that they are best borne between breakfast and dinner. This is consistent with general experience as to baths.

The cases in which these baths have been found useful are very numerous. Chronic rheumatic affections and gout, gouty enlargements of the joints if recent, lumbago, and sciatica. Weakness, the result of habitual attacks of gout; partial palsy, spinal debility, dyspepsia, especially in gouty habits, neuralgic affections from old wounds. These are some of the principal diseases in which Buxton is famous. In sprains and muscular contractions it is especially so used in the form of douche.

Abundance of cases showing the good effects of the baths might be quoted.

There is a difference of opinion as to the satinization of the skin by Buxton waters. Some have experienced this agreeable sensation, others not.

The climate of Buxton, from its elevation and the mountainous character of the surrounding country, is rainy; but, from the dry character of the limestone on which it is placed, the rain soon runs off.

### MATLOCK.

It is a misnomer to call Matlock a spa: the slightly tepid waters, 68°, appear to be almost pure—slightly calcareous. Matlock is an elegant sanatorium, and nothing more.

# SECTION B.

## MINERAL WATERS SOUTH OF THE TRENT.

THE division of English mineral waters here made is not purely artificial; for there is a decided difference in the character of the northern and southern waters of England. In the north sulphur waters prevail. In the south the sulphated saline waters are more common. In the south there are no sulphuretted waters bearing the least comparison in point of power with the waters of Harrowgate, Askerne, Croft, Dinsdale, and Gilsland. Chalybeates and saline springs are common throughout England.

These waters may be divided into the saline, as Woodhall, Tenbury, Willoughby, Ashby-de-la-Zouch, Victoria Spa, near Stratford; Gloucester, Leamington, Cheltenham, Kilburn. The thermal waters of Bath, Bristol, and Malvern. The chalybeate waters of Sandrock and Dorton, Tunbridge, Brighton, Hastings, Hampstead.

# CHAPTER VII.

Brine Springs.—Woodhall, or the Iodine Spa.—Too much importance attached to the presence of minute quantities of Bromine and Iodine.—Analogies between Chlorine, Bromine, and Iodine, and their compounds.—Tenbury, Ashby-de-la-Zouch, Victoria Spa, Gloucester, all Salt Springs.—Victoria Spa more Sulphate of Soda.—Leamington Springs mentioned by Camden.—Their Early History.—Analysis of the Old Well.—Goold's Spring and Baths.—Other Wells.—Royal Spa and Pump Room.—Saline Chalybeate.—Analysis.—Properties of the Leamington Waters.—Dr. Granville's Account of the Sulphur Waters of the Royal Pump Room.—Little utility of Baths of such Waters.—Diseases in which the Waters are useful.—Cheltenham.—Discovery of the Water.—Analyses of Abel and Rowney, and Mr. Cooper.—Want of Gas in Cheltenham Waters.—Has Silica any Medicinal Properties?—Sulphuretted Hydrogen, Iodine.—Properties of the Waters.—Old Indians.—Liver Disease.—Causes.—Sir Charles Scudamore's Opinion of the Value of Cheltenham Waters.—'Plumbophobia.'—*The Solution.*—Continental Prejudice against the Use of Mercury.—Cheltenham's Loss of Reputation.—Well fitted for Old Indians.—Montpellier, Pittville, and Cambray Establishments.—Climate of Cheltenham.—Melksham.—Metropolitan Spas.—Epsom.—Its former Reputation.—Kilburn Spa once much frequented.—Its Composition.—Possessed of real Virtue.—Hockley Spa.—Beulah.—Hampstead.—New Islington, or Sadler's Wells.

## WOODHALL, OR THE IODINE SPA.

This spa, not much known except in the vicinity, is about three and a half hours' journey from London, by the Great Northern Railway, and there is a station at the spot, with a branch railway to Kirkstead, so that access is easy. There is a hotel within the grounds possessing every accommodation for visitors. The peculiarity of this water is, that it contains more bromine and iodine than any other English mineral water. According to Mr. West, its composition is, in a pint—

| | | |
|---|---|---|
| Chloride of sodium | 189·6 | grains. |
| Sulphate of soda | 0·25 | ,, |
| Bicarbonate of soda | 0·75 | ,, |
| Chloride of calcium | 3·33 | ,, |
| Chloride of magnesium | 1·41 | ,, |
| Iodine | 0·55 | in the gallon. |
| Bromine | 8·35 | ,, ,, |

It is therefore a strong saline spring.

The presence of the iodine and bromine has caused the water to be much recommended in the whole class of scrofulous affections. The baths have been much used also in rheumatic affections and skin diseases. The opinion of the writer that too much weight has been attached to the presence of minute quantities of iodine and bromine in waters already containing large quantities of chlorides has been given. This opinion is founded upon the great law, that the chemical analogies of bodies are imitated by analogy of action. Now there is not a chemical group whose analogies are more striking than chlorine, bromine, and iodine, with their compounds. Some years ago the writer made the group the subject of an experimental investigation,* and as bromine and its compounds were the least known, they were more particularly selected. The result was not only to confirm the beautiful law already referred to, but to lead him to pursue it into more minute details. Thus it was found that the salts generally had the properties of the base, as those of potassium, sodium, iron, etc. It was also found that, on the whole, the activity was as the solubility and facility of decomposition : thus, in the case of the iodide, bromide, and chloride of potassium, the iodide is the most soluble, most easily decomposed, and most active; the bromide next in all respects, and then the chloride. In Woodhall water the iodine doubtless exists in the form of iodide of sodium, and it does not seem likely that so minute a quantity, when there is already such a large quantity of chloride of sodium, can be of much avail. Nevertheless the iodine can be detected in the unconcentrated water, and may, especially with the addition of the bromide of sodium, increase the activity of the chlorides. It is possible the common use of the chloride of sodium may render the system habituated to it, and thus the bromide and iodine may be the more medicinal from the stomach not being accustomed to them.

---

* "On the Physiological and Medicinal Properties of Bromine and its Compounds;" also, "On the Analogies between the Physiological and Medicinal Properties of these Bodies, and those of Chlorine and Iodine, with their correspondent Compounds," being the Harveian Prize Essay for 1842.—*Edinburgh Medical and Surgical Journal* for July and October, 1842.

From its composition the Woodhall water is well adapted for external use. The baths are comfortable and commodious, but the situation of the spa and grounds is low. The water was discovered in a vain search for coal. The well is one hundred and seventy yards deep, and the water is raised by a contrivance called the hydraulic belt, worked by several horses. The supply of water never fails. When drawn it is somewhat turbid and opalescent, but brisk and sparkling. The temperature is 55°; the taste is briny. A tumbler of it acts as a mild aperient. In scrofula, the object being to procure absorption, the water should be drunk in small quantities, and often. On the whole, this water seems worthy of more attention than it has yet received.

Lodgings can be obtained near the spa.

### TENBURY.

According to Sir Roderick Murchison, the red marl, or upper layer of the new red sandstone, is the great saliferous depôt of England. The water was found in searching for drinking water. It is situated not far from Ludlow, and can be reached by the Shrewsbury and Hereford Railway. According to Mr. West, in a pint, there are muriate of soda 62·07 grains, muriate of lime 35·22,* carbonate of lime 0·26, muriate of magnesia 0·96, sulphate of magnesia 0·10, silica 0·1, iodine 0·013, bromine 0·008, azote 0·73 of a cubic inch, carbonic acid 3·00. It is thus clear that the chief medicinal element is the muriate of lime. This powerful salt is in sufficient quantity to exercise marked effects, and no doubt the water, like all the salt springs, is capable of producing good results in scrofulous and cutaneous affections. Of the same class is Willoughby, in Warwickshire, except that it contains a little sulphur; the salt-wells near Dudley come under the same category. None of these brine springs is likely to be of much use as a mineral water.

---

* The reader is reminded that chloride of sodium and muriate of soda are the same.

### ASHBY-DE-LA-ZOUCH.

Three miles from Ashby a powerful saline spring arises in a coal-pit, termed the Moira mine. The water is brought to the town, and used for baths. The hotel appropriated for this purpose is very comfortable, and not ill-adapted as a place of residence for an invalid. The analyses of the water published differ materially; but, in fact, this spring is just one of the strong brine springs which abound in England. As it is situated in the middle of England, it may be used with advantage by those for whom salt-water baths are recommended, and who are unable to reach the sea-side. Any comments on such a water are superfluous.

### VICTORIA SPA,

Near Stratford, has a different composition. It contains in the pint, of chloride of sodium 9·46 grains, sulphate of soda 60·57, muriate of lime 2·05, bicarbonate of soda 3·44, sulphate of magnesia 4·06, bicarbonate of magnesia 1·84, 0·64 of a cubic inch of sulphuretted hydrogen. The great feature then in this water is the sulphate of soda. A drachm to the pint of such a powerful purgative as Glauber salt is quite sufficient to produce medicinal effects. The water has been recommended in stomach and liver diseases, in gravel, and anomalous gouty and rheumatic affections. Dr. Granville praises the hotel accommodation and the baths. It is very convenient that we possess these establishments scattered through the country, as they enable invalids, who could not get to the great spas or sea-side, to indulge in the luxury of mineral baths in their own locality.

### GLOUCESTER SPA

Is another of these salt wells, containing chiefly about fifty grains of common salt, and ten grains of sulphate of soda, to the pint. It cannot be considered of material importance.

### LEAMINGTON.

This place, now so populous and splendid, in the year 1811 only contained sixty houses, and 543 inhabitants. The springs, however, are mentioned by Camden, and by Fuller in his wonders of Warwickshire. Dr. Kerr, in 1784, first strongly recommended Leamington. Two years after a new well was sunk, and two baths, one hot and one cold, were erected. Dr. Johnstone, of Birmingham, followed; and in 1790 a new well was discovered, and additional baths were built. In 1794 Dr. Lambe published his account of Leamington waters in the fifth volume of the "Manchester Philosophical Transactions." The fame of the place went on increasing as new waters were discovered; but what did most for Leamington was the colossal reputation of Dr. Jephson, who is said to have had the most lucrative practice of any physician of his day.

The most ancient of the springs is a little east of the church, near the river Leam: it is called the Old Well. This water, also called Lord Aylesford's, is the most in use. The springs are all close together.

The analysis of Lord Aylesford's gives in a pint—

| | | | |
|---|---|---|---|
| | Chloride of sodium .. ...... | 40·770 | grains. |
| | Sulphate of soda ............ | 40·398 | ,, |
| | Chloride of calcium ......... | 20·561 | ,, |
| | Chloride of magnesium .. ... | 3·266 | ,, |
| Gases— | Carbonic acid ............... | 2·103 | cubic inches. |
| | Nitrogen ...................... | 0·537 | ,, |
| | Oxygen ........................ | 0·075 | ,, |

On the opposite side of the street are Goold's spring and baths. The water contains more common salt than the Old Well, but in other respects its composition is very similar; besides the old warm and vapour baths, there is a large Turkish bath, and the baths are most luxuriously fitted up. The Old Well has a temperature of 48°; according to Dr. Granville, is clear, and pleasantly salt. Curtis's Well is near the Royal Parade. It contains less muriate of soda, and twenty grains more of muriate of magnesia than any of the others. The Victoria Well and pump-room are near the bridge. The ingredients are the same as those of the others; in fact, the composition of all these waters is very similar. On the opposite bank of the Leam is the Royal Spa and pump-room, with excellent baths, and a promenade ground. The waters are a weak sulphur spring and a saline chalybeate. The amount of sulphuretted hydrogen, however, is only one cubic inch to the pint, with six grains of sulphate of soda, five of chloride of sodium, and three of chloride of calcium. The saline chalybeate has in a pint—

| | | | |
|---|---|---|---|
| Sulphate of soda......... | 32 | grains. | |
| Chloride of sodium...... | 67 | ,, | and 3 cubic inches |
| Chloride of calcium ... | 20 | ,, | of carbonic acid. |
| Chloride of magnesium. | 12 | ,, | |
| Oxide of iron ........... | 1 | ,, | |

This water is very much used.

Mrs. Lee's Wells are likewise a sulphurous and saline chalybeate, very similar to those of the Royal pump-room, except that the sulphur water contains more salts, and the same quantity of sulphuretted hydrogen—viz., one cubic inch to the pint.

The composition of the Leamington waters sufficiently indicates their powers. They are aperient and alterative. Dr. Granville gives a sad account of the sulphur water at the Royal pump-room. He says—" It is a water having an exceedingly nauseous taste, and a most objectionable look besides, being of a dark yellowish green hue, with many floating particles in it. Doubtless the darkness of the colour may be ascribed to the folly of employing a lead pipe to pump the water up; still its origin, which I feel convinced is in the bed of peat earth of that low piece of ground that lies between the south wing of the pump-room and the bank of the Leam (a very narrow space), would sufficiently explain the peculiar tint of the water; and such, I repeat, is the difference that will always be observed between the genuine sulphuretted waters from rocks (which are the only pure and fit to use in medical practice), and those derived from bogs and quagmires. Add to it, that in the present instance of the sulphurous water of the Royal pump-room—the source of which is on the very border of a small river, of a deep, dirty, and muddy appearance, thickish and scummy on the surface, and receiving the drainage of the town—the sulphuretted hydrogen gas may, by the infiltration of such river water through the bank, be derived to some extent from its decomposing ingredients." It is more than probable that Dr. Granville is right in this conjecture, for this water differs from the other Leamington waters, all so similar, by containing much less amount of solid matters. I agree entirely with this writer in his opinion of the little efficacy of a plunge in Leamington water.

We know from positive experiment, that when a person stays long in a bath there is absorption of the water through the skin, and of course introduction of its ingredients into the system; but a plunge-bath or a shower-bath of Leamington water cannot differ from an ordinary spring water bath in medicinal operation.

The diseases most likely to receive benefit from Leamington waters are stomach and liver affections, irregularities in the female system depending upon deranged digestion, habitual constipation, with headaches, skin diseases, and perhaps scrofula, although the waters are not so likely to be useful as the more pure muriated springs, which are not so apt to purge, and therefore are more likely to enter the system, and produce the alterative effect. The climate of Leamington is very moist.

### CHELTENHAM.

In the case of this spa the instinct of animals first led to the discovery. It was noticed, in 1716, that flocks of pigeons daily resorted to the head of a small stream in a meadow distant a few furlongs south of the town, for the purpose of feeding on particles of a white salt casually formed from the water by the heat of the sun. But the circumstance which brought Cheltenham fairly before the public was the cure of George the Third by drinking the Royal Old Wells. Since then numerous sources have been discovered. There are four establishments at Cheltenham—the Montpellier, Old Royal Well, Pittville, and Cambray.

These wells have a general resemblance. It seems as if water impregnated with salts could be found by boring sufficiently deep into the lias on which Cheltenham is built. The waters are all pumped up in lead pipes. At the Montpellier establishment the drinker is served at a counter, with No. 1, 2, 3, 4, 5, as if it were so much liquor at a bar; the pipes come up in one shaft.

Very elaborate analyses have been made of late years of Cheltenham waters, which are here given.

Messrs. Abel and Rowney have analysed the Cambray (chalybeate), Pittville (strong saline), sulphuretted saline, No. 1 Royal Old Wells, and strong saline, No. 4 Royal Old Wells.

## *Royal Old Wells.*

No. 1.

| | Cambray Chalybeate. | Pittville Strong Saline. | Sulphuretted Saline. | Strong Saline, No. 4. | |
|---|---|---|---|---|---|
| | Grains. | Grains. | Grains. | Grains. | |
| Sulphate of Potash | 0·4781 | 2·9592 | traces | traces | In an imperial gallon. |
| Chloride of Potassium | 5·0491 | — | — | — | |
| Sulphate of Soda | — | 112·8666 | 234·0562 | 94·9410 | |
| Chloride of Sodium | 1·2138 | 481·1933 | 229·7876 | 590·3310 | |
| Bromide of Sodium | — | 3·2928 | — | — | |
| Iodide of Sodium | — | traces | traces | — | |
| Carbonate of Soda | 4·1867 | 20·1481 | — | — | |
| Chloride of Magnesium | — | — | 52·6197 | 8·0003 | |
| Bromide of Magnesium | — | — | — | 3·0632 | |
| Iodide of Magnesium | — | — | — | 0·4361 | |
| Carbonate of Magnesia | 4·3624 | 11·3897 | 1·9719 | 6·8026 | |
| Chloride of Calcium | — | — | 9·2575 | — | |
| Bromide of Calcium | — | — | 2·0272 | — | |
| Phosphate of Lime | 0·5579 | traces | — | traces | |
| Carbonate of Lime | 25·1209 | 7·7021 | 22·0808 | 17·0611 | |
| Biphosphate of Iron | — | — | 0·1834 | — | |
| Carbonate of Iron | 2·8938 | — | 0·5999 | traces | |
| Silica | 0·6678 | 2·7755 | 1·0129 | 2·7468 | |
| Apocrenic Acid | 0·1470 | — | — | — | |
| Crenic Acid | 0·2429 | 0·3591 | 16·8245 | 0·3332 | |
| Organic Extract | 0·0098 | 3·4993 | 0·0231 | 180·530 | |
| ,, Solids | 64·186 | 646·177 | 570·4447 | 741·7683 | |
| Free Carbonic Acid | 19·919 cubic inches. | 16·294 cubic inches. | 16·254 cubic inches. | 25·294 cubic inches. | |

According to Mr. Cooper's Analysis of the Montpellier Spas, there consists in the gallon:—

| | Muriates of Soda, | Muriates of Lime, | Muriates of Magnesia. | Sulphates of Soda, | Sulphates of Lime, | Sulphates of Magnesia. | Carbonates of Soda, | Carbonates of Lime, | Carbonates of Magnesia. | Oxide of Iron. | Iodide of Sodium. | Solids. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Montpellier No. 1, Saline Chalybeate | 216 | — | — | 117· | 10·4 | 32·0 | 8·80 | — | — | 2·4 | trace | 387·20 |
| No. 2, Ioduretted and Sulphuretted Chalybeate ...... | 284·4 | — | — | 227·20 | 24·8 | 59·6 | — | — | — | 3·36 | 1·2 | 596·5 |
| No. 4, Pure Saline | 419·2 | — | — | 137·6 | 21·6 | 113·6 | 9·6 | Carb.Mag.8·8 and Iron | | — | trace | 710·4 |
| No. 4 A, Strong Ioduretted Saline | 411·2 | 66·4 | 60·0 | 112·0 | 16·8 | 136·8 | 19·2 | — | 25·6 | — | 2·0 | 850 |
| No. 5, Ioduretted Magnesian Saline | ·77·60 | 104·8 | — | — | 24·8 | 376·0 | 13·6 | — | — | 3·2 | 2·80 | 686·0 |

| Gases:—Montpellier.— | Free Carbonic Acid. |
|---|---|
| No. 1 | 20· cubic inches. |
| No. 2 | 3·2 ,, |
| No. 4 | 11·2 ,, |
| No. 4 A | 12·8 ,, |
| No. 5 | 9·6 ,, |

With the single exception, then, of the Cambray chalybeate, these are all powerful saline springs, although none of them is so strongly charged with salts as the old Sulphur well at Harrowgate. The quantity of iron in the gallon of the Cambray chalybeate is not very great, and the quantity of carbonic acid, although sufficient to lighten it a little, still leaves it exposed to the fundamental defect of so many English spas, whose iron sits heavy on the stomach for want of gas. The quantity of silica in the Pittville saline is unusually large. As this substance occurs in so many mineral waters, it might be worth while to inquire how far it is capable of exerting any medicinal effects in a state of solution. The term sulphuretted waters, applied to those of Cheltenham, is a misnomer. The quantity of iodide of sodium in the ioduretted waters is greater than that in Woodhall—emphatically called the iodine spa; and the quantity of iron No. 2 of the Montpellier spas is considerable. In the Pittville saline there is an unusual quantity of bromide of sodium, and a fair proportion of carbonate of soda, which might give it antacid properties. The large quantity of magnesian salts in the ioduretted magnesian saline of the Montpellier well (No. 5) is also a fact worthy of note. Where an aperient action is required, this water should be preferred to all the Cheltenham waters.

Let us consider the properties of these spas, and the advantages to be drawn from them.

Cheltenham waters have, as is well known, derived an almost supreme reputation in the treatment of the diseases of hot climates, in old Indians whose livers have been overtaxed in tropical climates, and return to their native land to see if yellow gold will enable them to get rid of cirrhosis of the liver. The cause of this disease is similar essentially to Bright's disease of the kidney, already spoken of. In those climates the lungs are not worked as in cold regions, and an excess of depuration is thrown upon the liver. This is the reason why hot climates are so beneficial in obviating a tendency to disease of the lungs. These organs are there comparatively inactive, their great function, that of maintaining the temperature of the body, being not required in such intensity. The diet often indulged in by residents in hot climates favours the development of disease of the liver and digestive organs. Sudden chills, throwing the blood upon the central organs, tend to the same effect. The liver over-stimulated behaves as the kidney does under like circumstances. Repeated congestive attacks of the liver lead to the effusion of lymph, which blocks up the ducts of the liver; and the bile enters the blood or its secretion diminishes. The same obstructions often cause abscesses to be formed. Such saline waters as those of Cheltenham, which act as regular aperients, keeping up a gentle action on the bowels, and favouring the elimination of the bile, while at the same time, by their saline and chalybeate principles, they improve the tone of the stomach, and when absorbed act as alteratives, are the very remedies indicated by the nature of the case. Perhaps, too, a place like Cheltenham, where luxurious accommodation can be procured, is a fitter place for such invalids, accustomed to much ease and attendance, than a mere rural spa. They require, too, various distractions, which they can here have in perfection.

Sir Charles Scudamore makes some excellent observations on the use of Cheltenham waters in this very important class of patients. "The composition of these waters," he says, "is to be esteemed important, not merely as containing ingredients of an aperient nature, but as being truly alterative; or, in other words, possessing powers which operate medicinally in a gradual manner, not affecting the patient very sensibly at the time, but tending from day to day to alter and improve the functions of the digestive organs, and, consequently, to change the conditions of the whole system. This important effect belongs to them—that an invalid can pursue a continued daily course, such as produces a regular and considerable action on the bowels, without suffering that debility of the constitution and impaired appetite which are apt to occur from a similar course of saline aperients at home."

He then goes on to remark on the necessity of preparing the system for the waters in the class of cases spoken of. As a general rule, a mercurial purgative should be administered before the waters are drunk. Caution, too, should be used in taking the waters, and the state of the bowels attended to. If the waters be incautiously taken, they may do harm, merely carrying off a quantity of fluid; and therefore a mercurial purge, as blue pill or calomel, should also be sometimes taken during the use of the waters. Besides, an action on the liver should in this way be kept up. Even when the water does not suit the patient as an aperient, its use need not be abandoned. It may be taken with the view of improving the digestion and acting as an alterative.

It would seem to be a good practice for the invalid to drink one of the strong salines, somewhat warmed, when an aperient effect is desired, early in the morning, and the Cambray chalybeate might be taken in the forenoon. It is hardly necessary to say, after the observations on Croft and Dinsdale, that Dr. Johnson's observations on Dr. Granville's *plumbophobia* at Cheltenham are perfectly correct. With waters so loaded with salts there is not the least fear of any solution of the lead of the pipes used in bringing the waters. And how else could they be brought to the light of day but by pumps and pipes? A bad practice exists of adding to the waters a solution of the Cheltenham salts, by way of causing additional purgative effects.

The Cheltenham waters are hardly used for bathing; and, in fact, they have no properties to fit them peculiarly for such a purpose. Nevertheless, in liver disease, it is important to act on the skin, and hot baths form an appropriate part of the treatment.

The class of gouty and rheumatic affections also find benefit at Cheltenham. Here it is more the alterative effects that should be sought for. It would be better to take the saline waters in small doses through the day at intervals than in one or two large doses. Here, too, the patient should be prepared by the use of moderate doses of mercurial alteratives. It is astonishing to what extent the prejudice against the use of mercury in any form is carried, especially on the Continent. Except in very peculiar constitutions, there can be no objection to the moderate use of blue pill or calomel. To these diseases may be added a state of *malaise*, arising from torpor of the bowels, and cases of plethora, attended with headaches.

In skin diseases, and in dyspepsia, depending on torpidity of the bowels, the Cheltenham waters have been long acknowledged as of great utility. Generally speaking, what has been said of the saline waters applies to them. The baths are best taken in the forenoon or evening.

If Cheltenham has lost something of its reputation as a spa, the circumstance must be attributed, as in the case of Bath, to its extension as a city. There is something in the assemblage of splendid palaces at these two places, as well as at Leamington, which contradicts the idea of privacy and seclusion, most desired by many invalids; but, as has been already said, to several of the invalids most likely to be benefited by the waters of Cheltenham, its various *distractions*, to use a French phrase, are more likely to be useful.

The Royal Old Well has been lately re-edified, and a noble music hall, where concerts are given, erected. The following is a table of old analyses of the springs. In a pint—

| | No. 1. | No. 2. | No. 3. | No. 4. | |
|---|---|---|---|---|---|
| Chloride of sodium | 58·20 | 22·60 | 17·60 | 47·80 | grains. |
| Chloride of calcium | 6·21 | 3·68 | 3·08 | 4·29 | ,, |
| Chloride of magnesium | 2·54 | 5·16 | 3·30 | 7·30 | ,, |
| Sulphate of soda | 14·56 | 52·30 | 43·20 | 59·20 | ,, |
| | 81·51 | 83·76 | 67·18 | 118·59 | ,, |

The waters most used are the Old Well, No. 1; No. 2, called sulphuretted saline; and No. 4, strong saline. The water is not disagreeably saline, and a few bubbles of gas escape when it is held in a glass. But there is no taste of sulphur.

The Montpellier pump-room stands in a fine situation, on elevated ground. It is surrounded by a handsome colonnade, which is well adapted for exercise. There are evening promenades, concerts, &c.

The Pittville pump-room is, perhaps, the most handsome building of the kind in England. It is 90 feet long by 43 in depth. It is surrounded by a colonnade 20 feet in width, and the roof is supported by fluted columns 22 feet high, with rich cornices, and the whole surmounted by a dome. From an external gallery, which surrounds the dome, fine views may be had of the Bristol Channel, the Welsh, Malvern, and Cotswold hills, Gloucester Cathedral, the winding course of the Severn, Tewkesbury Abbey, and the rich valleys of Evesham and Gloucester. The grounds, too, are very beautiful, containing fine walks and drives.

The Cambray Spa has a handsome pump-room, and, finally, on the Park estate, there is another small pump-room, and saline springs.

The Montpellier baths are an extensive range of buildings in the Bath road, within a few minutes' walk of the High-street. There are fourteen separate baths on the premises, for warm or cold bathing, besides shower-baths, hot air, medicated, and sulphur baths, douches, shampooing. Also a large swimming bath, with a plentiful supply of running water from springs on the premises, kept at an average temperature of 70° by means of steam-pipes.

Cheltenham has several literary institutions and educational establishments, well suited for the education of youth of both sexes, amongst which the Cheltenham College takes a high standing.

The average temperature of the years from 1830-37 was 50·21°. The general temperature is less subject to extremes of heat and cold than London. The winds are generally south and south-west. The average fall of rain is 33 inches. The annual mean of days on which rain falls 110 days. In

London rain falls on 178 days. The oldest part of the town is built on a plain, with an ascent southwards to the Lansdowne and Park districts. Pittville is in the opposite direction. In every respect Cheltenham seems admirably adapted as a place of residence for families from the East or West Indies. There are many fine seats and places of interest in the neighbourhood. The population is about 35,000.

The waters may be taken at any time of the year, but the season is said to be from the middle of March to the end of October.

### MELKSHAM.

I am only acquainted with this place through the notice of it by Mr. Lee.* According to him, it is situated half a mile from the town of Melksham, itself eleven miles from Bath. At the spa there is a row of four houses. There are two springs, one a chalybeate and the other a saline. The waters are artificially charged with gas, and sent to a distance. Solid constituents (of which spring is not stated) 156 grains to the pint. There are baths at the place, douching apparatus, and medicated baths to be had. The town of Melksham affords accommodation, and the country is fine and open.

### METROPOLITAN SPAS.

There are several springs near London, some of which were once greatly celebrated, and which are not to be despised altogether. Certain it is that waters have been, and are still used in many places, whose pretensions to medicinal power are not one whit better founded. Among these may be mentioned Epsom, Kilburn, the new springs of Hockley and Beulah, and the chalybeate springs of Hampstead and Islington.

### EPSOM

Was one of the earliest mineral waters after Bath and

---

* "Watering Places of England." 1854.

Buxton, to obtain a reputation. It was discovered in the time of James the First by one Wicker, who found that in the holes made by his cattle in the ground near the spring a somewhat bitter water was formed, and that the animals refused to drink this. It got a great reputation towards the close of the seventeenth and beginning of the eighteenth century, when George of Denmark, the consort of Queen Anne, drank the water. Lodging-houses, various places of amusement, and taverns were accumulated near the spot. Toland wrote a description of it in the beginning of the eighteenth century, in which he says that on a Sunday evening he counted sixty coaches in the ring. One of the taverns, the New Inn, was the largest in England. One of the elegant amusements consisted in trying to catch a pig by the tail. About this time one Livingston got a lease of the place, and having started new wells, shut up the old. Speaking of the new wells, just before this, Toland says: "The old wells, at half a mile from the town, which formerly used to be the meeting-place in the forenoon, are not so much at present in vogue, the waters, they say, being found as good within the village, and all the diversions in greater perfection." Livingston died in 1727, and before that the place had revived for a moment under the stimulating influence of the South Sea scheme, and was like a fair, frequented, we are told, by alchemists, Dutch, Germans, and Jews. Mr. Ingram, a surgeon, retired from practice in London, between 1760 and 1770, advertised Epsom salts, obtained by evaporating the water, which at one time had an immense reputation, and sold for five shillings an ounce. On the Continent, in particular, they were in great demand. The waters, however, lost gradually their reputation, and in 1805 a dwelling-house was built on the site. In 1822–23 Dr. Pidduck and Mr. Whitlaw induced some to go to Epsom for scrofula, liver disease, and other affections; but although the well exists, as a spa it is numbered with the things that were. I am not aware of any modern analysis; but Dr. Saunders, A.D. 1805, speaks of it as being one of the first of the saline purgative springs that were brought into use. He says it is transparent, colourless, scarcely sapid; that it keeps well, if kept in carefully closed vessels, but soon putrifies if exposed to the air.* According to Dr. Lucas, a gallon of it yielded five drachms, and a scruple of salts, of which four or five-sixths were sulphated magnesia (Epsom salts), the rest muriates of lime and magnesia, which render it deliquescent, and an insoluble residue of sulphate of lime. This once celebrated spa was therefore a moderately strong saline water, having for its chief ingredient the sulphate of magnesia. A tumbler of it would contain less than a scruple of sulphate of magnesia.

## KILBURN.

Kilburn Wells were well known and much frequented in 1773, and the water was extensively sold in London. According to the analysis of Bliss, published in 1802, the water is not unworthy of notice.† He gives in a wine gallon—

Iron not appreciable.

| | | |
|---|---|---|
| Carbonate of lime | 8·4 | grains. |
| Carbonate of magnesia | 10·75 | ,, |
| Extractive matter | 3·00 | ,, |
| Muriate of magnesia | 33·0 | ,, |
| Muriate of lime | 14·7 | ,, |
| Muriate of soda | 18·0 | ,, |
| Sulphate of soda | 117·5 | ,, |
| Sulphate of magnesia | 265·0 | ,, |
| Sulphate of lime | 42·0 | ,, |
| Insoluble matter | 1·5 | ,, |

In all no less than 513·9 grains in the *wine* gallon.

This analysis is corroborated essentially by one in the "Royal Society's Transactions" for 1792, by M. Schmeisser, communicated by Sir Joseph Banks. Mr. Bliss found gaseous contents, carbonic acid eighteen, and azote five cubic inches. There were three wells, but only one is now to be found. I visited it lately : it is in a stable to the north of a railroad. The well is deep, and the supply of water abundant. It emits globules of gas in a glass, and has an agreeably saline flavour, while the *après goût* is decidedly magnesian. I have had carbonic acid forced into the water, and thus treated it is equal, if not superior, to any artificial Seltzer water. There is a somewhat similar water near Acton. A rhymer says of Kilburn—

---

* Doubtless from the decomposition of sulphates by organic matter.

† "Experiments and Observations on the Medicinal Waters of Hampstead and Kilburn." By John Bliss, M.R.C.S. London, 1802.

"Oh, were thy virtues but as fairly known,
As universal as their good foretells,
How should we hail thee Pyrmont of our own,
And bid adieu to all the foreign wells."

I am very much inclined to consider the Kilburn water as one possessed of very fair medicinal properties : of the same class as the Cheltenham and Leamington waters. My own attention having been only recently attracted to the waters I am unable to give a detailed analysis, but believe from the tests I have applied that the results of Mr. Bliss are substantially correct.

### HOCKLEY SPA.

The story of the discovery of this mineral water, as told by Dr. Granville, is, that a couple who had long resided at Cheltenham, having come to reside at this place, the wife was seized with asthma, to which she had been formerly subject, except when using the Cheltenham waters; but that, on drinking from a new well close to their residence, all her asthmatic symptoms subsided, to return when she went to reside in London away from the water of the new well. This awoke attention to the possibility of the well possessing medicinal properties. The water was sent to parties in the neighbourhood, and in the end a spa was formed. The water has little taste or flavour, and I must confess I should be inclined to doubt if the large quantity of sulphate of magnesia given by Mr. Phillips's analyses, viz., 41·26 grains to the pint, in addition to other salts, it is true of no great activity, exists in it. If useful at all, it must be as a *very* mild aperient. The good lady's relief from asthma might perhaps have been otherwise accounted for than by the spa; and also some other cures, by the situation near Southend and the sea.

### BEULAH SPA,

Easily reached from London either by railway, or riding, or on foot, from its ascribed constitution would seem to justify the recommendation of Dr. J. Johnson to parties who required an alterative and mild aperient. It contains, according to analysis, nearly 100 grains of solids to the pint, of which 61·5 are sulphate of magnesia; so that two or three tumblers of it should exercise a sensible effect.

### HAMPSTEAD.

Certainly, if any site could be more favourable than another for a spa, it is that of Hampstead, so near London, and possessed of such fine air, and such charming environs, with an almost endless variety of beautiful walks. Close to the Wells Tavern there is a chalybeate spring, which flows in a sufficiently copious stream, near a chapel, which was once a pump-room. This spring was known before 1698. In the beginning of the eighteenth century, the waters were recommended by Dr. Gibbons as quite as efficacious as "any chalybeate in England, except Scarborough, which is purgative," and, probably, with a considerable amount of truth, except as regards the copperas springs. He used himself to drink two or three glasses every morning, when business or the season permitted. "The chalybeate waters at Hampstead being of the same nature and equal in virtue with Tunbridge Wells, sold by Mr. Richard Philps, apothecary, at the Eagle and Child, in Fleet Street, every morning, at threepence per flask, and conveyed to persons at their own houses for one penny per flask more. The flask to be returned daily."—*The Postman*, April 20, 1700.* According to Mr. Bliss, they contained 6·75 grains of salts in the wine gallon, of which 1·5 were oxide of iron. The analysis is probably correct. There were also in the gallon 10·1 cubic inches of carbonic acid gas, and 90 of air less pure than the atmosphere. In other words, it may be presumed that there is here a very considerable amount of this nitrogen, to which so much has been ascribed in the case of Buxton. The water is certainly most agreeable to drink, and it is probable that many a denizen of London, condemned to sedentary pursuits, would find no mean benefit from a matutinal walk to Hampstead, and a good draught of this healthsome spring.

### SADLER'S WELLS, OR NEW ISLINGTON SPA.

About the time of Charles II. there seems to have been a kind of spa mania, as witness the recent fame of Tunbridge, Scarborough, Harrowgate, and Epsom, and the spreading fame of Bath. Perhaps this might have something to do with the dissipated habits of the age, and the often inefficient and disgusting, sometimes rude and violent, pharmacopœia in use, leading people to look to the resources which nature offered them.

"Near the River Head is a spring of chalybeate water, in a very pleasant and retired garden, containing some large and handsome trees. This spring was a century ago much resorted to by our nobility and gentry for its medicinal virtues, and it obtained the above name from its similarity to the waters of Tunbridge Wells, in Kent. The spring was discovered by Sadler, a surveyor of the highways, in 1683, on the site which he had then just opened as a music-house."† This well was famed before the Reformation; and the priests of St. John, at Clerkenwell, took it under their protection. It was called "Holy Well." The gardens were much frequented at the beginning of last century for the sake of the waters; in 1733 by the Princesses Amelia and Caroline. The spring is still in existence, like Hampstead, a light chalybeate. Both these waters present a good topic for the writers on mineral waters, who talk so much of the advantages of "extreme dilution, fine division of particles," and so forth. Sadler's Wells did not want its poet-laureate any more than Kilburn.

---

* "History of Hampstead." By J. G. Park. London, 1818.

† "The History, Topography, and Antiquities of the Parish of St. Mary, Islington." By John Nelson. London, 1811.

"For three times ten years I travelled the globe,
Consulted whole tribes of the physical robe,
Drank the waters of Hampstead, Bath, Harrowgate, Dulwich (Norwood ?)
Spa, Epsom, and all by advice of the college.
But in vain till to Islington's waters I came,
To try if my cure would add to their fame.
In less than eight weeks they produced a belief
This would be the place of my long-sought relief," etc.

# CHAPTER VIII.

Bath.—Probably known to the Druids.—Made a great City by the Romans on Account of its Waters.—The Saxons.—Legend of Bladud.—Its State at the Reformation.—Queen Anne of Denmark —Mary of Modena.—Its subsequent Career.—Character and Properties of the Waters.—Directions for their Use.—Bath as a Residence.—Clifton; its former Reputation.—Malvern.—Tunbridge.—Brighton.—Hastings.—Sandrock.—Isle of Wight.—Bournemouth.—Torquay.—Observations on the Climate of the Southern Watering Places.—Dorton.

## BATH, BRISTOL OR CLIFTON, MALVERN, AND OTHER ENGLISH SPAS.

As Matlock was classed with Buxton, so Clifton may be ranked with Bath; both are thermal springs, and Bath in strength of saline ingredients and temperature asserts a greater superiority over the so-called Hot Wells of Clifton than Buxton over Matlock. Again, both Clifton and Matlock are admirably adapted as sanatoria.

### BATH.

This ancient city, renowned for so many ages for its waters, may well be termed the king of English watering-places.

The discovery of these waters through Bladud, as reported in the legend, appears at first thought ridiculous enough; nevertheless, it may embody a traditional truth that these waters were known to the Britons before the arrival of the Romans. The story, first promulgated it is said by Jeffrey of Monmouth, is, that Bladud, son of King Hudibras, having become a leper, was banished from his father's court, and became a swineherd. That then he communicated the disease to his pigs, and that these animals discovered the springs through an instinct, of which Bladud, having seen the good effects on the animals, profited in his own case. We have seen good reason for believing that the ancient Gauls were acquainted with the virtues of some of these springs, and why not the Britons, whose Druids were confessedly the most skilful of their craft? Be this as it may, the Romans soon availed themselves of the thermal waters of Bath. It is supposed to have been a Roman station A.D. 43. Agricola, who commanded in Britain A.D. 78, dedicated a temple to Minerva at Bath. It is mentioned by Ptolemy, A.D. 150, under the Greek name Ὑδατα θερμά. The Itinerary of Antoninus mentions Bath as Aqua Solis. A college of armourers was founded at Bath by Adrian for the manufacture of the arms of the legions. Among the numerous remains of the Roman period found at Bath, the most important were the remains of an extensive bath discovered in 1755. They were twenty feet below the level of the surrounding streets. "The site of these buildings, at once the most splendid, as well as the most ancient structure of this description erected in our country, appears to have extended over the ground now occupied by Abbey-street, extending to Church-street on the East, and to the Abbey-green on the south. The buildings consisted of a centre and two wings, and embraced first, a bath running north and south, forty-three feet in length and thirty-four in breadth, enclosed within walls eight feet high, built with wrought stone lined with terras, and ornamented with twelve pilasters; secondly, a semicircular bath, to the north of the former, measuring from east to west fourteen feet ten inches, ornamented with four pilasters; thirdly, two large rooms to the eastward, designed for *sudatories*, having double floors, on the lower of which stood rows of pillars composed of square bricks, sustaining a second floor of tiles thickly coated with cement. The stones and bricks had evident marks of fire, and the flues were thickly charged with soot. One of the furnaces which heated these hypocausts was still visible, and at its mouth were scattered pieces of charcoal and burnt wood. Succeeding excavations brought to light another semicircular bath to the southward, corresponding to that already described, and evincing that this noble establishment must have occupied an area two hundred and forty feet from east to west, and one hundred and twenty at the broadest part from north to south. The building was highly decorated with tesselated pavements, columns, pilasters, and every ornament of classical architecture, and contained the various conveniences which rendered the Roman method of bathing so much more pleasurable and salutary than our own. A regular set of well-wrought channels conveyed the superfluous waters from the baths into the Avon."

Remains of a temple of Minerva worshipped at Bath, and numerous altars and other remains have also been found. The Saxons called the place Badan and Bathan, and also by the significant name of Akeman Cester. They renovated the baths, and several of their kings used the hot waters.* John de Villula, the bishop, had a grant of the city from William Rufus; he repaired the baths. Shortly afterwards these were vested in the prior and monks, on condition they should be kept in a state of repair, and always be fit for the use of the Royal Family when at Bath. In consequence of a neglect of this, a process issued to the sheriffs, A.D. 1235, to levy the sum of £13 11s. upon the prior and monks, the amount of an estimate of the cost of reparation of the king's houses and the king's bath.

Both sexes used to bathe together in a state of nature. Bishop Beckyngton issued a mandate in 1449 against this unseemly practice, but it continued till the end of the 16th century, when the corporation interfered.

Just previous to the dissolution, the following account of the baths is given by Leland:†—"There be two springes of whote water in the west-south-west part of the town, whereoff the bigger is called the Crosse Bathe, bycause it hath a crosse erected in the middle of it * * * * * and is temperate and pleasant, having eleven or twelve arches of stone in the sides for men to stonde under yn time of reyne. Many be holpp by this bathe from scabbes and aches. * * * The other bathe is a two hundereth foote of, and is lesse in compasse within the waulle, than the other, having but seven arches yn the waulle. This is caullid the Hote Bathe, for at cumming into it, men think that it would scald the flesh at the first, but after that the flesch is warmid it is more tolerable and pleasaunt. * * * * * The colour of the baynes is, as it were, of a depe blue se water and riketh like a sething potte continually, having sumwhat a sulphurous and sumwhat a pleasant savor." The notice of the blue colour is worthy of being remarked, especially after what was said of Buxton.

---

* Bulwer, in the novel of "Harold," notices the fondness of the Saxons for the bath.

† Warner's "History of Bath."

Dr. William Turner published in 1562 "A Booke of the Nature and Properties as well of the Bathes in England as of other Bathes in Germanye and Italie." He never heard any mention of the waters of Bath till after his return to England. Notwithstanding his publication, little or nothing was done till the close of the 16th century, when Queen Elizabeth vested the baths in the corporation; and by the liberality of a Mr. Bellot the Queen's Bath was erected. The occasion of its being called the Queen's Bath was this—As Anne of Denmark, Queen of James the First, was bathing in the King's Bath, there arose just by the side of her Majesty a flame of fire like a candle, which had no sooner ascended to the top of the water than it spread itself upon the surface into a large circle of light, and there became extinct. This frightened her Majesty, who went to the new bath, hence called the Queen's Bath. There is only one gas which could produce this phenomenon, viz., phosphuretted hydrogen, and the appearance described corresponds very much with what would take place from a sudden evolution of this gas.

Numerous writers in the 17th century praised the waters. Queen Catharine of Braganza visited them, doubtless with the same expectation as that which took Marie de Médicis to Bourbon Lancy, and Anne of Austria to Forges, "*ut faciat se parentem pulchra prole,*" but with a less favourable result. But in the year 1687 the waters of Bath, if the belief of the parties chiefly concerned may be credited, had, like the French waters in the cases referred to, much to answer for, being visited by Mary Beatrix, Queen of James the Second, with the same object. The Earl of Melfort erected a cross in the Cross Bath to commemorate the event of the birth of him who was afterwards known in such a melancholy manner as the young Pretender. It bore—

"In perpetuam
Reginae Mariae memoriam,
Quam Coelo in Bathonienses Thermas,
Irradiante, spiritus Domini qui fertur
Super Aquas,
Trium regnorum haeredis
Genetricem efficit," etc.

The history of Bath during the eighteenth century is one of continually increasing prosperity and enlargement. The new pump-room was opened in 1704, under the auspices of the celebrated Beau Nash, on which occasion an ode characteristic of the taste of the parties concerned was recited. It began—

"Great Bladud, born a sovereign prince,
But from the court was banished thence,
His dire disgrace to shun.
The muses do his fame record,
That when the bath his health restored,
Great Bladud did return."*

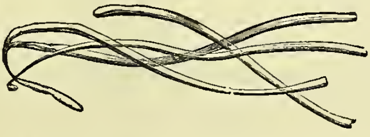
For the after history of Bath the various guide-books are referred to.

---

* A very curious collection of Bath poetry might be formed, including, of course, the whimsical "Bath Guide" of Anstey, whose muse, however, could be pathetic as well as comic. Witness his beautiful lines soliciting the assistance of the charitable for the Bath Hospital.

The three public baths are the King and Queen's Bath, the Hot Bath, and the Cross Bath. These belong to the Corporation. There are also the Kingston Baths, which are private property.

The King's Bath is sixty-five feet ten by forty feet two. The water rises from a spring of the temperature of 116°, which discharges the enormous quantity of about two hogsheads per minute, and is twelve hours in filling the bath. There are seats and recesses round for the accommodation of bathers, and one side is formed by a Doric colonnade, to afford shelter from the weather. There are two rooms adjoining, with pumps for directing the water on any particular part of the body, called dry-pumping. The Queen's Bath, a retired portion of the King's Bath, is twenty-five feet square, supplied from the same source as the latter. Its temperature is said to be 112°. In point of fact, these baths have generally a somewhat lower temperature, the King's Bath, from its size, having round the edges a temperature of little more than 100°. The Cross Bath has, of all, the lowest temperature, being only 99°. The Hot Bath has a temperature of 118°; but, according to Dr. Granville, under the pavement in the Leper's Bath, connected with the same source, the temperature is 120°. There are three sources of these baths—The King's, the Cross, and the Hot Bath. The source of the Kingston Bath is between the King's Bath and the river Avon. The temperature is a little lower than the King's Bath. The Royal private baths, supplied from the same source as the Hot Baths, contain every convenience; the baths, large and roomy, may be had of any temperature up to 114°. There is every kind of douche, vapour baths, and elegant dressing-rooms. The



CONFERVA TENUISSIMA, FOUND IN BATH WATERS.

tepid swimming bath is sixty-five feet by twenty-five, and the water has a temperature of 88°.

The analyses of Bath waters show every stage of the progress of the art of analysis.

The first idea we have of their composition and origin is, that Bladud buried some tuns charged with combustible and saline materials by his witchcraft, which fermenting in the bowels of the earth, originated the waters.

> "Two tunne ther beth of bras,
> And other two imaked of glas,
> And salts ther beth in,
> And other thing imaked with ginne;
> Quick brimstone in them also,
> With wild fire imaked thereto,
> Sal gemmae and sal petrae,
> Sal ammoniac there is eke,
> Sal albriod and sal alkine.
> * * * * *
> And burneth both night and day,
> That never quench it ne may."

Such were the chemical ideas of five hundred years ago.

I take the following curious argument from Dr. Short's "History of the Northern Mineral Waters," as recent, be it remembered, as 1774:—"Thus, for example, Dr. Mahow, on the Bath water, tells us 'That because any alkaline salt meeting with the water, causes a precipitation, and because, if you pour into boiling milk, it coagulates the milk, therefore that water contains an acid salt, and yet that it has an alkaline salt complicated with this acid, because its sediment ferments with acids.' But had he first made the experiment he would have found sea-water coagulate boiling milk, and that sea-salt ferments with oil of vitriol; but is sea-water, therefore, an acid salt, combined with an alkaline?" Precisely so.

To quote the numerous analyses of Bath water would exceed the space that can be allotted. The two upon which most dependence can be placed are those of Mr. Walcker and Mr. Noad.

| | In an imperial pint—Walcker. | In a quart—Noad. |
|---|---|---|
| Chloride of calcium | — | 5·4500 |
| Chloride of magnesium | 1·67 | 1·4800 |
| Sulphate of soda | 2·42 | 6·9600 |
| Carbonate of soda | — | 1·2000 |
| Sulphate of lime | 10·20 | 13·3100 |
| Chloride of sodium | 1·89 | — |
| Carbonate of lime | 1·33 | — |
| Alumina | 0·01 | — |
| Silica | 0·41 | 0·7000 |
| Oxide of iron | 0·03 | 0·1087 as carbonate. |
| | | Error 0·6913 |
| | 17·96 | 29·9000 |

According to Mr. Walcker there are 0·20 of a cubic inch of carbonic acid in a pint. According to Mr. Noad the carbonic acid is combined with soda. All the modern analyse of Bath water differ somewhat even to the specific gravities. Thus Mr. Noad gives only 14·95 solids to the imperial pint, and the specific gravity of the King's Bath being 1002·4. Sir Charles Scudamore nearly agrees as to the specific gravity, but differs entirely in the estimate of solids, and of the nature of the constituents; and Phillips and Herapath differ from him and each other. In one respect all agree—viz., in stating the chief solid constituent to be the sulphate of lime, and very nearly in the estimate of its quantity. According to Dr. Daubeny, nitrogen is evolved from the centre of the Queen's Bath at the rate of 240 cubic inches per minute from an area of twenty feet, and while 126 gallons of water are discharged. This is an interesting fact, taken along with Dr. Playfair's discovery of such a large quantity of the same gas at Buxton, although the quantity is not nearly so large in proportion to the amount of water in the latter.

Bath water in a glass is clear and colourless, and sends up no bubbles; gives, in fact, no sign of briskness or effervescence. On standing exposed for some hours it becomes somewhat turbid, and a pale ochrey precipitate separates. When the water is drunk hot from the pump the mouth is filled with a strong chalybeate taste, and hardly any taste of salt, but there is an earth-like sensation. When the water has been boiled, no iron can be detected.

As for the diseases in which Bath water has been used externally and internally, *nomen illis legio.* The list of writers and works alone would form a small catalogue, and their books a library.

We may begin with gouty and rheumatic affections. All observation tends to show that it is in the chronic, and low and atonic forms of these diseases, that the Bath waters do most good; and in irregular, wandering, and masked forms of the disease. Bath water is excitant; it powerfully stimulates the circulation. Hence, in gout, with anomalous head and other affections, it tends to bring out the gout, as it is phrased. When this occurs the symptoms should be treated in the ordinary way; and then the treatment by the baths and water resumed, when a cure is almost the invariable result. Before commencing the treatment by the baths and ingestion of the water, it is well to prepare the patient by the administration of a dose or two of a mercurial preparation, or perhaps, where there is much head affection, vertigo, or acute symptoms affecting any other organ, by leeching or counter-irritation. There are cases, however, where the waters used internally are too exciting, and where they should either be given in small doses frequently repeated to act as alteratives, or abandoned altogether. When the waters agree, the effect is to produce great exhilaration of the spirits, a genial glow throughout the system, and increased action of the skin and kidneys; also, according to Dr. Falconer, of the salivary discharge. The dose of the water generally recommended is half a pint twice a day. Authorities differ. Perhaps the best plan is to take the first dose before breakfast, the second at one p.m. The bath may be taken in the forenoon or evening. The patient should stay in twenty minutes, as a general rule, in chronic gout or rheumatism, be well dried and rubbed afterwards, and if the weather be fine, he may take gentle exercise. The bath may be used twice or thrice a week. Its effect, if it agree, is to cause an agreeable warmth of the skin, considerable perspiration at first, and afterwards a warm, open skin. If the circumstances, as has just been said, admit, nothing can be more favourable than moderate exercise; but great care is required to prevent a sudden chill; and for this reason, if the bath be taken in the evening, it is better for the patient to seek repose soon afterwards. Where there is enlargement of the joints, or local pains in either chronic gout or rheumatism, the douche should be employed.

The great stimulant properties of the Bath waters render attention to diet more than usually necessary. Moderation and simplicity above everything—the absence of salted meats, of shell-fish, red fish, spices; the making use of butcher's meat only once a day, taking no supper, or if any, something light, as a boiled egg and bread, with perhaps a glass of sherry negus; little wine at dinner, no multitudinous mixtures even of vegetables, the abandonment of rich soups and sauces, are the essential particulars to be attended to.

For the same reason the state of the bowels should be carefully watched.

If the gouty or rheumatic symptoms be obstinate, there is no reason why general and local measures of a different kind should not be combined with the use of the waters. Of all remedies, hardly any possesses the direct power over the gouty and rheumatic constitution which is exerted by colchicum. It promotes the biliary secretion, and acts upon the bowels and skin, but, above all things, it is a real diuretic, increasing not merely the quantity of urine, but the amount of solids discharged, and especially of uric acid and urea, and thus it frees the blood of its morbific principles, whether it be excess of albumen and fibrin, or actual urea and uric acid circulating in the system.*

---

* Dr. Prout made urea the product of the conversion of the gelatinous tissues in secondary digestion, and derived the uric acid from the albuminous. But this can hardly be; for while the gelatinous tissues hear a small proportion to the albuminous, thirty times as much urea as uric acid exists in the urine. Besides, Liebig showed that uric acid might be con-

Unfortunately, colchicum is apt to disagree seriously with the stomach of most individuals. The usual mode of obviating this is to combine the colchicum with magnesia or soda, which is besides useful as an antacid. The most powerful combination that can be used in gout or rheumatism as an alterative, is to unite colchicum with some of the preparations of iodine, especially the hydriodate of potass. I have been in the habit, when desirous of producing a great effect in the way of perspiration in some diseases, and gout is one of them, of giving, but rather in the acute form of the affection, a kind of Dover's powder at bed-time, but with two grains of calomel, and six of the golden sulphuret of antimony, with one grain each of ipecacuanha and opium, which form the active ingredients of that valuable preparation, instead of the eight grains of almost inert sulphate of potass with which they are combined in the pharmacopœia. The local use of iodine may be combined with the use of the baths, where there are swellings of the joints; that is to say, the joint may be painted with tincture of iodine, or hydriodate of potass ointment rubbed in. There is probably no remedy for producing absorption equal to the subiodide of mercury, the analogue of calomel; but then, applied locally as an ointment, or taken internally, it is apt to produce the constitutional effect of mercury. Finally, galvanism, for the application of which there are now so many modes, may be used either to enlarged joints, or where the disease affects more particularly the muscular or nervous sheaths, as in sciatica and lumbago. These modifications of rheumatism are very successfully treated by the waters of Bath. Sir C. Scudamore, in speaking of this class of diseases, concludes with remarking that when a bath of a temperature lower than 94° does good, the patient may be considered in a state of preparation for Buxton.

---

verted in respiration into urea; and thus we may understand how exercise may assist in enabling a gouty man to get rid of his excess of uric acid in the form of the more soluble urea. And how the excretions of some torpid animals—as reptiles, which live much on animal food—may consist almost solely of uric acid.

The usual duration of a course of Bath waters is six weeks, but there is no reason why it should not be prolonged when the waters do good, but yet a cure is not effected.

In visceral obstructions from the consequences of intermittents and other diseases of warm climates, in inert liver, and chronic dyspepsia, with slight jaundice, the waters have been recommended. Their action should be assisted by occasional doses of blue pill and saline aperients.

In the extensive class of diseases of the skin, Bath waters, and especially their external use, have been renowned, as we have seen, in all times. And it is easy to see how a remedy whose tendency is to excite so powerfully this organ, the skin, may be beneficial both locally, and by altering the state of the secretions which have so much to do with the disease, perhaps as the primary cause, perhaps as an effect reacting as a cause; and here Dr. Tunstall makes a remark, with which all who have seen much of skin disease will be disposed to agree, viz., that however minute and beautiful may be the distinctions drawn by pathologists between diseases of the skin, forming, in fact, the most accurate classifications of disease in medicine, practically these distinctions are not of so much value.* In fact, the different classes sometimes merge into each other; thus eczema or tetter, it might be remarked, placed amongst vesicular diseases by some, merges into impetigo; or pustular disease, characterized, after the eruption has lasted some time, by a thick yellow, honey-like crust, instead of the thin scale of eczema; the fact being that in impetigo, the cutaneous eruption is characterized at first by a more intense inflammation. Instead of a vesicle containing a clear fluid, a pustule holding matter or thick lymph is formed, which gives rise to the thick yellow crust spoken of, instead of the scale of eczema. But sometimes the disease assumes a form intermediate between eczema and impetigo, it is then called eczema impetiginoides, or eczema-like impetigo. In the same way, chicken-pox, a vesicular disease, is seen passing into small-pox, a pustular one. It follows, then, that as the same cause, differing only in intensity, may give rise to apparently different forms of cutaneous disease, so the same kind of remedy may be available in different forms. Although some of these diseases are specific, indeed, and can only be treated by specific remedies, as itch, where the presence of an animal parasite causes the disease, and favus, where it is produced by a vegetable; in few diseases is there a greater choice of means than in most skin diseases. When I attended at the Hôpital St. Louis, the great French skin hospital, in 1838, M. Biett cured almost all his cases by internal remedies, while M. Emery, another physician, preferred external treatment. Having since then had a good deal of experience myself in this class of diseases,* I have seen the necessity for combining both systems, so as to cure as rapidly and completely as possible. But all who have had much experience of skin disease must have met with cases, for no apparent reason, obstinately rebellious to treatment which answered in other cases seemingly of the same character, or if the disease is cured for a time, it often breaks out anew. I may mention especially lepra and eczema, especially eczema of the aged, and the various forms of skin disease, very often anomalous, occasioned by the excessive use of mercury in a vitiated habit. And such cases are, perhaps, precisely those in which powerful medicines are least borne. Here, then, is a field for the employment of thermal waters. Their use does not require any especial precaution; if they excite the skin too much, the temperature can be reduced. Other remedies, and especially alteratives, may be conjoined.†

---

* "The Bath Waters." 1850.

There is another extensive class of diseases in which the waters of Bath have been greatly recommended, viz., nervous and paralytic affections.

---

* For some years the writer, along with his friend Mr. Potter, had a private dispensary, supported by themselves and friends, for the treatment of skin diseases and scrofula.

† I may, perhaps, be permitted to take this opportunity of again calling the attention of my professional brethren to the interesting remedy Iodoform in several cases of skin disease, scrofula, and goitre; see—*On the Physiological and Medicinal Properties of Iodoform*, by R. M. Glover, M.D., *Edinburgh Monthly Journal of Medical Science*, April, 1848. The introduction of the remedy has been recently, according to the

In all these diseases, the great question is, as to how far the disease is merely functional, how far it is organic. In merely nervous affections, when pain is the chief symptom, the affection may depend on a variety of causes, and the treatment is often to a great extent experimental. Thus, sometimes a good dose of croton oil, followed by a course of mild aperients, will cure a case of tic-douloureux; at other times, very different drugs, large doses of carbonate of iron, the application of morphia to local blisters, or aconite, will effect a cure. Should other means fail, as they often do, there can at least be no harm in using thermal waters, especially if their general effect be beneficial. They should be used both in the ordinary way and by means of douche. In local palsy, much the same may be said. The waters appear to be chiefly useful where there is much debility. In an inflammatory state of the nervous centres, where there is impending apoplexy, or softening of the brain, they may evidently cause mischief by over-excitement, and frequently very great nicety of judgment must be required to determine between fit and unfit cases. All this must entirely depend upon the skill and sagacity of the physician. There are abundant cases of almost magical results from the use of the waters in these cases.

In the formidable diseases of paraplegia and hemiplegia, or paralysis of the lower part of the body, or of one side, the former often depending on disease of the spinal cord, and the latter on the brain, Dr. Tunstall's statistics, compiled from the records of the Bath Hospital, show in the former class 10 per cent. of cures, and between 30 and 40 per cent. cured and relieved. In the other, 5 per cent. of cures, and 30 per cent. cured and relieved.*

---

invariable French practice, claimed for M. Bouchardat. I anticipated him in every point, except in the use of the remedy in cancer, where, I believe, it will do harm.—See also *Lancet*, March 14th, 1857.

* According to Dr. Tunstall, the waters can often be borne a very long time in skin diseases. He thinks they modify the action of some remedies considerably. They appear to cause the patient to resist the

In local palsy, caused by the too long employment of a particular member in any monotonous occupation; and in palsy from the use of lead or other mineral poisons, the treatment by thermal waters has always been found beneficial. It will be sufficient to enumerate many of the diseases in which relief, with probability of success, may be sought from the waters of Bath. Among these are St. Vitus's Dance; the whole class of female diseases depending upon irregularity of the proper functions, except where there are organic diseases of other organs interfering with the use of the waters, and especially where there is tendency to hæmorrhage, in which they almost invariably do harm. Sterility is one of the cases in which good is done by thermal treatment, as many illustrious examples testify; douches here are clearly advisable. In all dyspeptic diseases characterized by debility, especially those arising from overworked brain, and in premature old age, good effects may be expected. In the effects of contusion, the existence of old wounds, which do not heal or have broken open, badly united fractures, and such like cases, the reputation of Bath is established. Finally, in some few pulmonary and bronchial affections of a chronic character, and in persistent hooping-cough, they may do good. In active phthisis, and generally wherever there is fear of danger from excitement of the circulation, they are almost sure to be injurious.

As usual, there has been much speculation concerning the causes of the good effects of these waters. We have, of course, the old story of thermal heat, and the difference between it and ordinary heat, and Dr. Tunstall states plainly that patients do not only bear a bath of the water more easily than an ordinary hot bath, but that afterwards they do not feel the lassitude which succeeds an ordinary bath; but, on the contrary, greatly increased vigour, and a grateful sensation, with increased flow of spirits. Be this as it may, Dr. Granville's graphic description of the

action of mercury and some other substances, and render him more susceptible to that of arsenic. This is a valuable fact, as the number of waters in which arsenic is found, and especially thermal waters, increases every day.

effects of the Bath water at 114° is precisely that of an ordinary powerful hot bath. Besides, the moving about in the water may have some effect. In the internal use of the water, much has been ascribed to the iron, and Dr. Falconer and others have conjectured that this metal might exist in the water in a larger quantity than, from some cause or other, it can be detected by chemical means. It has been argued that the effect of Bath waters in improving the state of the blood is precisely what might be expected from iron. Nitrogen has been invoked, as in the case of Buxton, but the water does not sparkle or emit bubbles, and, as has been shown, nitrogen is almost insoluble, so that what comes out with the water is not drunk at least. The same stimulating effects as those said to be experienced from drinking Bath and Buxton have been experienced, or supposed to be experienced, from Clifton hot-wells and Malvern. One fact remains. In many of the thermal springs, similar to Bath in their effects, the sulphate of lime is a chief ingredient. Now this substance is almost insoluble artificially, so that we know not its effects. May it not, assisted by the temperature, be the cause of the power of these waters? This substance is certainly not an aperient; and Bath waters are rather constipating. What other effect it may have we know not.

Sir John Forbes, when speaking of the waters of Leuk, in the Valais, recommends the trial of the system often pursued on the Continent with thermal waters, in the instance of these we are speaking of, the only hot springs in England. At Leuk, the people sit for hours in a piscina pursuing avocations, as playing cards, knitting, etc., and sometimes taking meals there. Doubtless considerable results might be produced by the long-continued action of such a powerful means on the skin, independent of the absorption which to some extent might be expected.

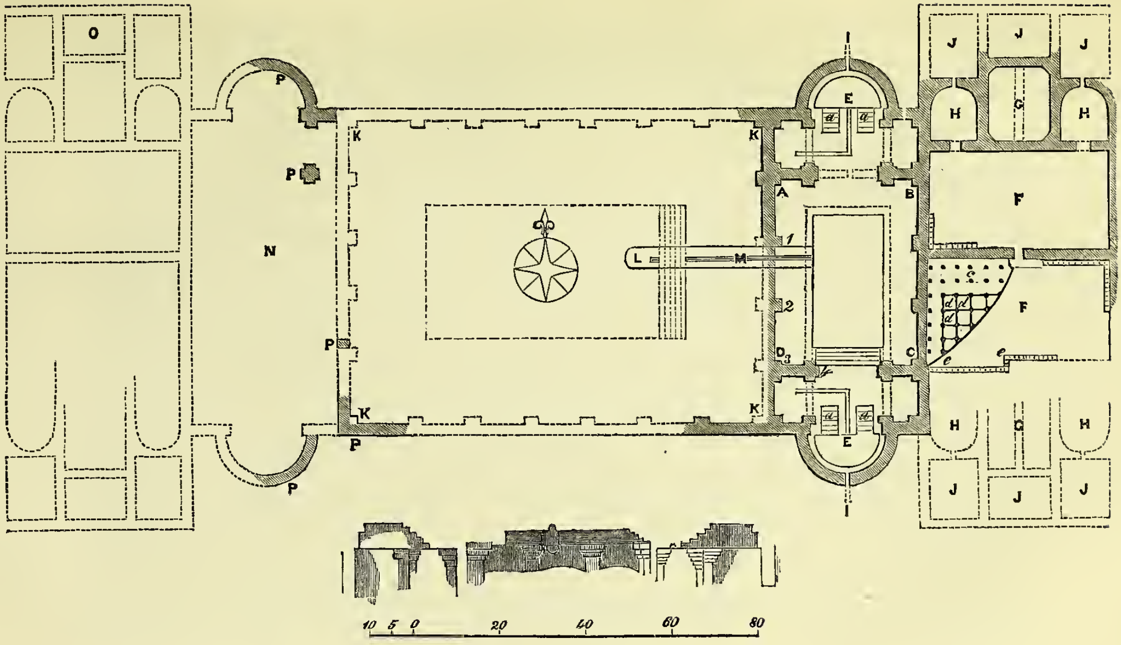
These waters cannot be considered of volcanic origin. The lowest part of the ground on which the city stands is alluvial, or lias covered with alluvium; the higher streets rise in succession, and the inferior oolite, and the great oolite, as at Lansdowne, 813 feet above the sea, crowns the whole.

The climate of Bath is on the whole favourable; the town is well sheltered from the north and easterly winds, and open to breezes from the south-west. The average temperature during the year is more by five degrees than that of any internal town in England. The climate is about as rainy as that of most parts of England; but from the porosity of the soil, and the way in which the ground of most of the town slopes towards the river, excess of moisture is soon carried off. Nevertheless, according to the registrar-general's tables, the average annual mortality is high, being for the years 1841—50 inclusive, 24 to 1000.

In summer the climate is considered relaxing. The alluvial part of Bath is at a lower level than any spa in England, except by the sea-side. The season is said to begin in November and terminate in April. When such situations as Buxton and Harrowgate are too exposed, therefore, Bath may be frequented.

It is needless to say that in this splendid city every comfort, convenience, and luxury may be obtained; that there are abundant sources of gratification and amusement; that the parks and surrounding country offer admirable promenades and drives; and that few cities in the world are better adapted as a residence for those who wish to crown a "life of labour with an age of ease."

Description of the Plan of Roman Bath.—A, B, C, D, bath, 41 feet long and 34 feet wide. E, E, two semi-circular baths. F, F, two vapour baths, whose floors were supported by pillars of brick, $1\frac{3}{4}$ inch thick, and 9 inches square, as at *c*, laid in cement, 14 inches apart. These supported a floor of tiles, 2 feet square; *d*, *d*, *d*. Brick tubes of a square form, from 16 to 20 inches in length, at *e*, *e*, G, G, furnaces for heating the vapour baths. H, H, H, H, tepid baths, with tesselated pavements. J, J, J, J, J, dressing-rooms. K, K, K, part of the greater bath, 90 feet long and 68 feet wide. L, leaden cistern. M, a channel for conveying water to the eastern square bath. Below is a section of the eastern bath as opened in 1765; the parts found tolerably perfect are in shade. N, western bath. O, supposed situation of the king's bath. P, P, P, P, P, the western sides of the baths, discovered between the years 1799 and 1803. 1, 2, 3, 7, 8, bases of pilasters which supported the roof. *a*, *a*, *a*, *a*, steps leading down to the semicircular baths. *i*, *i*, drains to carry off the water into the river. The walls discovered in 1756 were 6 or 7 feet high, built of stone and mortar, and lined with red Roman cement, then very firm. The section annexed represents the floor of the Eastern Bath, opened in 1755.



ROMAN BATH.

## CLIFTON.

This watering-place may be compared in many respects to Matlock, but the water has some more positive qualities. Few waters have a more extensive literature than the so-called Hot-wells of Clifton. Dr. Edward Jorden, of Bath, in his Treatise on Mineral Waters, A.D. 1632, briefly mentions them as ranking with the chalybeate waters of Spa and Tunbridge. After him followed a host of writers, of whom Dr. Venner, in his third edition of "Via Ricta ad Vitam Longam," tells us that besides their general use in stone, these waters cured ulcers of the urinary passages and intestines, provided they passed readily, hot liver, inflamed viscera in general, and adust humours. He warns the cold and phlegmatic against using them. He gave them either with honey, sugar, tincture of violets and roses, or cream of tartar. He attributed iron to them, also sulphur and nitre. He disregarded their outward use. Among other writers, Fuller, in his Book of Worthies, 1662, relates that St. Vincent's Well is sovereign for sores and sicknesses, outwardly applied and inwardly taken. It has a ferruginous taste, and beer brewed therewith is wholesome against the spleen. Dr. Samuel Ward, of Cambridge, we find, so drank it for the spleen at great cost, having it conveyed by sea and then inland. To enumerate all these opinions would be hardly worth while; it is sufficient if we know that there is not a disease, perhaps, extant, in which this now insignificant spa has not been recommended. The water issues from a limestone rock towards the river, the rock containing the specimens of crystal known as Bristol diamonds. The temperature varies from 73° to 76°. Its specific gravity is nearly that of distilled water. According to the last analysis, the composition in an imperial gallon is—

| | Grains. |
|---|---|
| Chloride of magnesium | 2·180 |
| Nitrate of magnesia | 2·909 |
| Chloride of sodium | 5·891 |
| Sulphate of soda | 3·017 |
| Sulphate of magnesia | 1·287 |
| Carbonate of lime | 17·774 |
| Carbonate of magnesia | 0·660 |
| Carbonate of iron | 0·103 |
| Bitumen | 0·150 |
| Sulphate of lime | 9·868 |
| Silica | 1·270 |
| | 44·209 |

The quantity of iron is obviously too small to exert any material power. The water is perfectly limpid and sparkling. It is said to keep well, and hence was much prized for ships on long voyages. It has been stated to freeze less readily than other waters.* Dr. Saunders remarks justly, that the Clifton waters may be taken more safely in every state of health than most other springs. Rather an equivocal compliment. According to Dr. Nott, the effects vary according to different constitutions. "The most general are drowsiness, vertigo, and sometimes an obtuse pain of the head; these may be accounted for on the principle by which Dr. Wall accounts for the same effects in the Malvern, viz., a temporary plethora occasioned by the ready passage of the water into the system; some gentle evacuants, with now and then an anti-spasmodic, relieve." So that here, as at Buxton and other places, and even at Malvern, mysterious effects are ascribed to the presence of minute quantities of ingredients.

The real uses of Clifton are as a sanitary residence. The lower part of the town is admirably sheltered; nevertheless still some authorities speak of the medicinal qualities of the water. Thus Mr. Edwin Lee—"The internal use of the water is considered to be very efficacious in cases of dyspepsia with acidity, in affections of the kidneys, in diabetes, gravel, and tendency to stone. It has also been highly spoken of in bronchial affections and predisposition to consumption, though in these cases the climate has been, doubtless, chiefly instrumental in the advantage obtained."

---

* Hotwell Waters, near Bristol; by John Nott, M.D. 1793.

The higher part of Clifton is a good deal exposed, and the lower part subject to fogs from the river. The mean annual temperature of Bristol is 53°; the average fall of rain was 29·56 in 1832, and 37·91 in 1838. It rains half the year, but the limestone soil causes drainage to be easy.

### MALVERN.

It would seem almost superfluous to describe Malvern amongst English spas, but for its belonging to the same class of places as Clifton and Matlock. Of the two waters, St. Anne's Well and the Holy Well, the former, according to Sir Charles Scudamore, contains in the wine gallon only 5·464 grains, consisting of muriate of lime, sulphate of soda, and carbonate of lime. It is, therefore, simply pure soft water. More with the view of again calling attention to what I regard as imaginary notions than anything else, I quote the following from Sir Charles Scudamore:—"The great benefit arising from Malvern water, as an external remedy in diseases of the skin and surface of the body, has led to its employment in some internal disorders, and often with considerable advantage. Of these the most important are painful affections of the kidneys and bladder, attended with discharge of bloody, purulent, or fœtid urine; the hectic fever produced by scrofulous ulceration of the lungs, or very extensive irritating sores on the surface of the body, and also fistulas of long standing that have been neglected, and have become constant and troublesome." He adds, like Dr. Saunders, in speaking of Bristol—"The Malvern water, though unquestionably of great benefit in many of the cases that we have just enumerated, is in general a perfectly safe application. . . . The internal use of Malvern water is sometimes attended with a slight nausea. . . . . The effects of this water on the bowels are not at all constant, frequently it purges briskly for a day or two; but it is not uncommon for the body to be rendered costive by its use; especially, as Dr. Wall observes, with those who are accustomed to malt liquors. In all cases it decidedly increases the flow of urine, and the health and spirits of the patient, &c.

"If my subject permitted me to indulge in romantic description, I should find it difficult to confine my imagination when engaged in any account of Malvern." Precisely so,—the air is admirably adapted for the residence of an invalid, whose lungs will bear an elevated site.

### CHALYBEATE WATERS.

First in importance of all the English chalybeates, more from historical interest than any other very particular reason, is Tunbridge Wells.

### TUNBRIDGE WELLS

Is situated in that part of Kent called the Weald, and partly in Sussex. It is a town containing 10,000 inhabitants. It is divided into three districts, exclusive of the new Calverley quarter—Mount Ephraim, Mount Sion, and the Wells in the valley. The best houses are on the mounts, detached, and with gardens. The Calverley consists chiefly of a splendid hotel and extensive grounds. Tunbridge includes more of the characteristic neat villa-like English houses than any other of our spas. The scenery is of the most varied description. The fine walk called the Parade is not to be exceeded for its noble trees. The geological features of the neighbourhood are of siliceous grit mingled with iron. These rocks are not covered, as in other parts of the country, by the chalk, but pass under it to the Downs. The sandstone contains so much iron, that it was worked extensively in many parts of the Wealds of Kent and Sussex, and the history of this manufacture forms an episode in that of the iron trade of England. The spa is situated at the end of a long wooden shed called the Pantiles, where the water is received into a basin, which it fills at the rate of one gallon per minute. It is unfortunate that, with the many advantages of Tunbridge, the spa should be greatly deficient in power. It is a heavy chalybeate, very poorly impregnated with gas, and consequently very deficient in agreeable qualities. The taste, too, is very feebly ferruginous. The quantity varies somewhat. According to Scudamore, the temperature is 50°, and the water never freezes. The water on being drawn into a glass begins soon to show a pellicle on the surface, which in forty-eight hours becomes iridescent. Its contents, except 0·28 grains of oxide of iron in the pint, are insignificant. There is accommodation for bathing, of a limited character. It retains its iron when heated to 140°, so that will not be precipitated in the stomach. Sir Charles Scudamore has paid particular attention to the use of this water. He recommends an aperient invariably before entering on a course of the water. If more than such simple treatment is required, the case is one for special medical consideration. The first dose of the water may be taken at seven in the morning, and the second about three in the afternoon. A small portion of biscuit before breakfast with the water is recommended. From half a pint to two pints daily is the quantity to be taken. Attention to diet should be carefully studied. Tea at breakfast should be avoided, lest the tannin of the tea should precipitate the iron. Cocoa or chocolate is preferable. The coldness of the water generally has a good effect on the stomach, but the water may be heated where the circulation is languid.

On its first employment, cold or warm, some inconvenient sensations may commonly arise, such as flushings of the countenance, slight fulness of the head, with drowsiness and an uneasy distension of the stomach, with more or less flatulence. Preparatory treatment is especially necessary where there is furred tongue with heartburn and occasional nausea and pink sediments in the urine. When it agrees, the appetite and spirits are increased, and the general energy and strength. Dyspeptic patients have received a very sensible support from the water, so as not to feel the necessity of luncheon in the middle of the day. Active exercise taken immediately after the water produces with most parties a kind of general glow, and this feeling of warmth is the result of increased circulation. Increased action of the kidneys is also a sign that the water is doing good.

The chief uses of the water are in chlorosis and uterine debility, also in cutaneous complaints connected with deranged digestion. Sometimes it may be well to mix sulphate of magnesia with the water. At other times increased doses of steel may be administered. Warm bathing will assist the internal administration. In the environs of London the mean difference of the temperature during successive months is 4° 7′, at Tunbridge only 3° 2′. The range of heat is less than in the environs of London, the difference of the warmest and coldest months being 25°. There is a great absence of humidity at Tunbridge, the average yearly fall of rain being 22·70 inches. The climate is comparatively cool, the average summer temperature being 59°, that of London 62° 3′, of Paris 64°, Rome 72°. The air is exceedingly bracing.

### BRIGHTON

Is the nearest point of the coast to London, and although more especially famous as a bathing place, yet possesses a spa not much inferior to others as a chalybeate. Besides other ingredients, it contains 1·66 grains of sulphate of iron to the gallon. Brighton is also celebrated for its German spas. Under the head of the German spas, the reader will see for what complaints these waters are especially suited; and the effects of the artificial waters of Brighton are calculated to approach these. The saline waters, sulphur waters, and ferruginous with carbonic acid, are especially well imitated by the artificial waters. Among these may be enumerated Pullna, Harrowgate, Karlsbad, and Spa.

Artificial medicated baths form a powerful mode of treatment—baths of soda have been mentioned. A new kind of bath has been lately invented by M. Pennes.* The elements of this very powerful mode of treatment consist of delphine, bromide of potassium, sulphate of alumina, sulphate of lime, sulphate of iron, sulphate of soda, phosphate of soda, and aromatic oils.

After ten or twelve minutes, the patients who enter them experience great heat of skin, which feels as if flogged with hot rods. There is general turgescence, and, with many, swimming in the head. After coming out the pulse falls, a gentle perspiration comes on, or the urine becomes clear and limpid. The person feels comfortable, skin cool and soft, appetite good, a sensation of youth is felt. These baths are very useful in abdominal swellings, and in cholera it is said, and especially in worn-out habits. Their precise formula is :— Bromide of potassium, 1 gramme (15·434 Troy grains), carbonate of lime, 1 ditto; phosphate of soda, 8 ditto; carbonate of soda, 300; sulphate of soda, 5; sulphate of alumina, 1; sulphate of iron, 3; delphine, 2 centigrammes, or 5 grammes of the concentrated tincture of stavesacre; 1 gramme volatile oil of lavender, 1 of the same of rosemary and thyme each. The influence of such a bath may be conceived to be very powerful.

### HASTINGS,

Too, possesses a spa, according to one analysis, of no mean power; indeed, more powerful than that of Brighton, and yet not so loaded with copperas as to be unfit for use, like that of Sandrock, to which we shall come directly. The composition is, in the gallon—

| | Grains. |
|---|---|
| Oxide of iron | 4·302 |
| Chloride of calcium | 4·978 |
| Sulphate of lime | 1·449 |
| Sulphate of soda | 3·017 |
| Sulphate of magnesia | 4·085 |
| Carbonate of magnesia | 4·640 |
| Silica | 0·385 |

And eighteen cubic inches of carbonic acid, with five of azote.

---

* "Bains Mineraux Artificielles." *Journal de Chimie Médicale*, May, 1857.

The mean temperature of Hastings is 50·62°; the rain 31·91 inches; the mean temperature of winter is 39·13; the mean of rain during winter 7·49. According to Sir J. Clark, Hastings is a very eligible place of residence for invalids.

### BOURNEMOUTH

Is another of these watering-places, which, according to Dr. Mainwaring, possesses a chalybeate like that of Hastings. During five years the mean temperature was—1847, 51·97°; 1848, 50·16°; 1849, 51·4°; 1850, 49·82°; 1851, 52·01°: while the annual fall of rain was—winter 7·116; summer 6·258; autumn 9·657.

### ISLE OF WIGHT

Is another of the favourite resorts of invalids, which possesses, at Sandrock, the most powerful iron spring in England, containing no less than 41·40 grains of sulphate of iron, and 31·6 of sulphate of alumina to the pint. It is clearly too powerful for internal use except in a diluted form, but there seems no reason why it should not be used in baths. The effect would be that of a powerful astringent, and, followed up by proper exercise, to stimulate the skin excessively. In several female diseases, and especially in some cases of green sickness, a dip in such a bath could not fail of stimulating the functions. In the same diseases, the internal administration of the water would be beneficial. As the dose of the sulphate of iron should not exceed two grains, it may be conceived in how diluted a form the water should be used.

Less rain falls at Undercliff than at any other part of the island—23·40 inches at Ventnor; at Newport, in the centre of the island, 33·60. Mean annual temperature 51·78°; that of winter 41·80°; spring 49·82°; summer 61·31°; autumn 53·95°. The climate of Undercliff, as far as equability of temperature is concerned, is superior even to Madeira. Comparing the climate of Undercliff with Torquay, Sir J. Clark observes—"With a temperature nearly the same, Torquay is soft, but rather humid and relaxing, while that of Undercliff is dry, somewhat sharp and bracing."

### TORQUAY.

These southern watering-places hardly come under the scope of this work; but as several of them have been named which had spas, it may appear as well to say something more concerning these great phthisical sanatoria. In the first place, unfortunately, we are very much in the dark concerning the absolute value of climate in phthisis. The best-established fact seems to be that as the British soldier goes from our own climate to a hot or a cold one he is less liable to phthisis.

Mr. Vivian has given a very favourable statement with regard to the climate of Torquay. According to him, the annual mean temperature is 52·1°; winter 44·0°; spring 50·0°; summer 61·2°; autumn 53·1°. Rain in inches, 28·20 annually. Average number of rainy days, 132; of other places, 160. Average fall of rain in other places, 30·37.

According to Dr. Shapter, Torquay is drier than Clifton 1·6 in summer, and during the year, by 4·1 inches, while it is cooler, as regards the mean temperature, 2·5° in summer. But the most important facts regard the mortality from phthisis. At Torquay, 1 in 61; Devon, 1 in 53; south-western counties, 1 in 52; south-eastern, 1 in 52; north-western, 1 in 37; London, 1 in 39; England and Wales, 1 in 45. Certainly, judging from these facts, the climate of the south-west of England appears very favourable to phthisical patients. Sidmouth, Plymouth, and other places have also pretensions to the same comparative immunity.

### DORTON,

A copperas spring, twelve miles from Oxford, not so strong as Sandrock, since it contains twelve grains of the sulphate of iron, where the other contains 41·40; but there is no essential alteration to be made in the views expressed in treating of that spa.

This concludes what I have got to say of the mineral waters of England. The reader will recollect that my view is meant to be a comprehensive one, to select the most reasonable statements made with regard to the virtues of the different waters, and above all to be eclectic.

If every account of the wonderful powers ascribed to mineral waters were listened to, the surprising part of the matter would be, not that men were sometimes well, but that they ever were ill. I have sought to disentangle the different opinions, and to give my readers, as far as I could, a means of thinking for themselves on the subject, and especially by referring as much as possible to principles, instead of dealing with mere details. To put the reader in possession of such principles as that, by means of them, he may direct his own judgment, has always appeared to me one of the chief aims which an author should have in view.

# PART II.

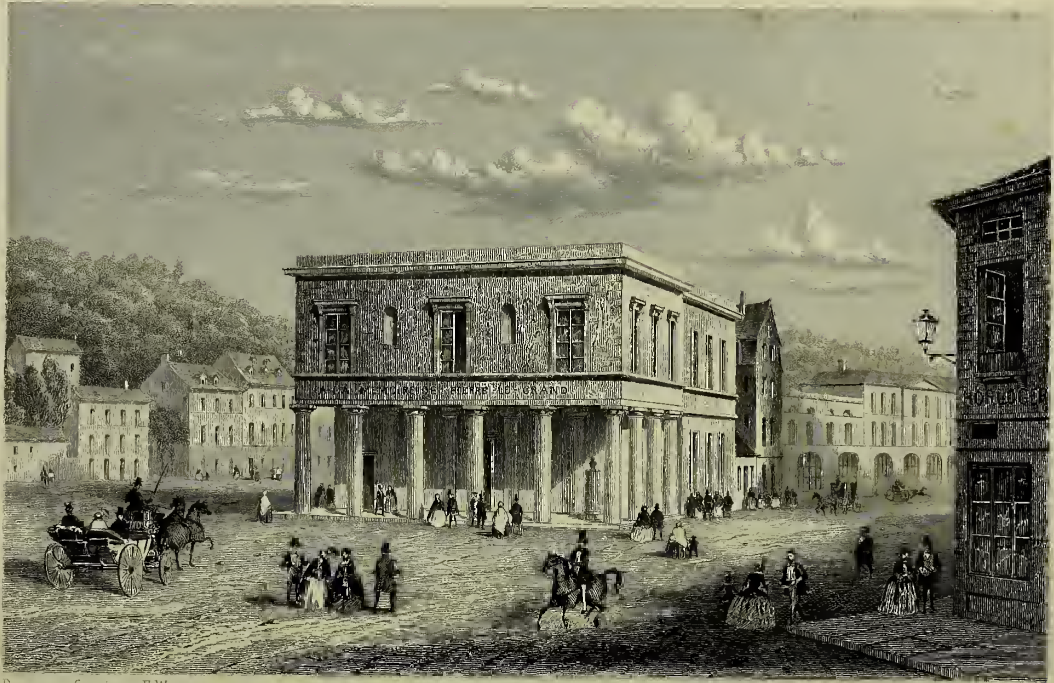
## THE MINERAL WATERS OF BELGIUM.—SPA.

Belgium possesses only one mineral water; but it is one of redoubtable fame,—the illustrious Spa, which, by its renown, has perpetuated its name, and given it to all mineral waters. Its efficacy, too, is considerable—its virtues undoubted. Spa is easily reached by rail from Bruxelles, and the station of Pepinsterre, whence there is an omnibus. Spa is situated at the foot of a steep mountain, which shelters it from the north winds. To the south is another mountain, partly cultivated, partly covered with rocks and trees, from which the principal springs come. The chief ingredient is carbonate of iron, held in solution by carbonic acid gas; the gas escapes copiously, and the water may be said to boil. Here, then, we have for the first time to encounter one of the greatest superiorities of the Continental chalybeates and other waters to our own. The carbonic acid not only communicates an agreeable sensation, as in soda water and other drinks, but, as has been already said, it causes the iron to sit easier on the stomach, and adds to its efficiency when absorbed into the blood.

The Pouhon is the only source found in the town. It is received in a quadrangular well, surrounded by a pavilion, on the front of which is an inscription, which states that the Czar, Peter the Great, recovered his health here. The temperature has been given at 10° of the centigrade. By litre, about 0·077 of a gramme* of carbonate of iron, or in an English pint, 0·6952 of carbonate of oxide of iron, and 0·884 or more than three-fourths its volume of carbonic

---

* A litre is to a pint as 1·76 to 1, and a gramme 15·434 troy grains.


A LA MEMOIRE DE PIERRE LE GRAND

Dessine et Gravé par E. Wormser.

N Remond imp. r. Vieille Estrapade, 15 Paris

SPA.

acid gas in the gallon. In another analysis lying by me, the total solids are put down at 0·43945 of a gramme, or rather less than four English grains in the pint, of solids altogether in the Pouhon, composed of carbonate and muriate of soda, lime, and magnesia. It is obvious that there is nothing but the iron and carbonic acid gas for the properties, but the iron is more than three times the quantity existing, according to Sir Charles Scudamore, in Tunbridge Wells, and there is the carbonic acid to confer activity. The Sauvinière and the Groesbeck are near together, about half a league from the town, and on the same side of the mountain as the next spa, the Geronstère, which is a league from Spa, surrounded with wood, and amid beautiful scenery. They contain about half the iron of the Pouhon. At half a league from Spa are the sources of the Tonnelet, the most gaseous of all. All these sources are of a similar character.

The waters of Spa, like all the waters of the same class, strengthen the digestion, give bloom to the countenance, and are especially recommended in female complaints, and as a remedy for sterility, and this quality is especially given to the Sauvinière; but the lady, when she drinks, must put her foot upon the print of the foot of St. Remacle, and repeat this during nine successive days. Such waters act by improving the tone of the whole system, rather than upon any especial organ.

It is unnecessary to repeat here what has been said of the tendency of iron waters to congest the head and produce constipation; those of Spa are particularly apt to do so. It is unnecessary also to repeat the precautions to be used. The practice with regard to the use of the waters is to begin with two or three glasses, fasting, and gradually to increase the dose. They should be used chiefly before breakfast and in the forenoon; they are drunk also with wine at meals:* the

---

* This effect of carbonic acid waters to produce a feeling like intoxication, was known by the ancients. Pliny says, "Lynstirs aqua quae vocatur acidula vini modo temulente facit." This was a river in Macedon. Probably few countries are richer in mineral waters than Turkey.

Sauvinière and Groesbeck are preferred for this purpose. It is almost needless to say that the accommodations at Spa are excellent, the walks and rides delicious, and that the place still preserves its aristocratic character.

---

### MINERAL WATERS OF FRANCE.

These are much less known in this country than the spas of Germany; nevertheless, they are both of great value and in great abundance, and, for the less degree of attention they have received, they are indebted first, to the distance of some at the feet of the Pyrenees, and to many of them being even yet not easily reached by rail, while some of the most frequented of the German spas are a day's journey from Brussels. Then the fact that the German Governments have made the establishments at their spas as splendid as possible, treating the matter as a national affair, and this combined with, in general, moderate charges, good attendance, great cleanliness, regularity, and order. In France, only seven sources belong to the Government, the rest are in the hands of departments or even communes, whose stinginess is well known, or perhaps even of individuals of limited means. It is not, as in England, where private enterprise can effect so much. In consequence, there is great neglect at many of the spas of those comforts and that attention which all travellers expect, and which are essential to the poor invalid, while a grasping, sordid spirit too often prevails. However, there are many exceptions; some splendid establishments have lately been erected, or are in course of erection, and when the communications become easier, and the extreme value of many of the springs, and the beautiful scenery amid which they are placed, better known, there is every probability that a great many of the waters of France, and even of Savoy, Italy, and other countries, will be preferred to those of Germany, so habitually flocked to by our countrymen with the regularity of birds of passage. Of medical advice, at least, and that of a good character, there is no lack.

The following is a general statistical summary of the waters of France. "France is one of the richest countries in Europe in mineral waters. Thus, we possess 950 sources, scattered over 331 points, which are so many stations of mineral waters. These 331 stations are divided into those which use the waters at once in baths, douches, and drink. Of these there are 133; those which only make use of it in drinks, of which there are 198.

"For the working of these stations, there are 217 establishments or concerns of different kinds. Among these establishments there are 153 which are directed by so many medical inspectors chosen by Government, and to whom it confides the delicate mission of presiding over the administration, as well as the rules of the service. But this title of inspector, although a guarantee to the stranger that he will not want for medical skill, confers no exclusive privilege." Any physician, in fact, may practise, but the foreigners must have permission from the French Government, which, in some cases, is not easily obtained.

---

As in the case of the mineral waters of England, those of France may be conveniently divided into three great divisions:—1st, Those of the Pyrénées; 2nd, those of the Centre; and 3rd, those of the East; leaving some stray ones to form a separate class.

# CHAPTER IX.

The Foot-print of St. Remacle.—Mineral Waters of France.—Statistics of them.—Mineral Waters of the Pyrénées.—The Sulphuretted Waters of the Pyrénées; Views of Anglada.—Central Situation of Pau.—Eaux Bonnes.—Report of M. Ducalde on Cauterets.—Its numerous Springs.—Sources of the North and South.—Uses of the Waters in Skin Diseases.—Saint Sauveur.—Baréges.—Bagnères de Luchon.—The Cagots.—Vernet.—Ax; Bad accommodation.—Saline Waters of the Pyrénées.—Ussat.—Bagnères de Bigorre.—Composition of the Waters.

## MINERAL WATERS OF THE PYRÉNÉES.

These are generally sulphurous, often thermal. They proceed often from granite, or schists of transition, rarely from metamorphosed calcareous rocks; they contain almost always soda as their base, seldom carbonic acid, but a mixture of azote and oxygen, not always in the proportion of atmospheric air: they often contain sulphuretted hydrogen, in addition to a sulphuret, and their temperature varies from 53° to 172°. It has been already stated that at one time sulphuretted hydrogen was thought to be the only principle which gave activity to these waters, but it is now known that this is due to an alkaline or earthy base combined with sulphur, perhaps in the majority of cases. This, as has been remarked, is a very valuable fact, as the sulphuretted water will retain its activity when heated. Anglada showed that the sulphur waters of the Pyrenees have generally the same temperature as those not hot, whence he argued that they all proceed from one source, but that the former have lost their temperature in the course of their passage from their common source to the places where they make their appearance. The cold springs have still a temperature near that of the air, and are generally near the hot springs.

## Central Situation of Pau as regards the Mineral Waters of the Pyrénées.

It is not the least advantage of the many which this city presents for the residence of an invalid, that it is in proximity to so many of the most celebrated Pyrenean waters. Its climate has been already referred to. Eaux Bonnes, Eaux Chaudes, Baréges, Canterets, Bagnères de Bigorre, and St. Sauveur, are all gathered, like a galaxy of stars, at an easy distance to the south of this city, amid the mountains of the Pyrénées.

### EAUX BONNES (BASSES PYRÉNÉES),

May be taken first. These waters are about twenty-six miles distant from Pau, the access from which is by a good road. Eaux Bonnes is a village at the foot of the Pie du Fer. It is composed of a single street, and ascended by a steep path. Before proceeding further, the reader should remember that Eaux Bonnes is 2000 feet above the level of the sea, and that, in general, the mineral waters of the Pyrénées are among the highest situated in Europe. The accommodation at this watering place is not good, and the supply of water itself but scanty. The waters are but little used for bathing, almost entirely for drinking. The chief source is called Vialle, and there are some smaller ones. The temperature is about 90° ; they have a marked smell of rotten eggs ; they contain, for what is supposed to be their active ingredients, 0·0214 of a gramme of sulphuret of sodium to the litre, or a low decimal more than ·19334 to the pint. This may show how small are the quantities which, as far as mineralization is concerned, are supposed to have effect; it is true they also contain a little sulphuretted hydrogen gas. They contain, however, 5·30 grains of solids in the pint, of which the greater part is chloride of sodium, and then sulphates of lime, and carbonates of lime and magnesia, with silica ; yet these waters are considered almost terribly energetic, and are given at first in very small doses ; in the dose of half a glass, which is gradually increased. Indeed so susceptible are some to the action of these waters that they have been given in doses of a spoonful at a time! They often produce a bath fever, which is a sign that a cure is about to ensue. There is then general excitement, restlessness, in fact, febrile symptoms. They are much recommended in bronchitic affections; and it seems especially on the organs of respiration that this effect, the *bad sturm*, is directed. Heat in the throat and tonsils occurs, and very much the symptoms of a severe cold with expectoration. It is found that these waters are not suited to cases of acute bronchial and respiratory affections, and where there is really much inflammatory action; and patients should be advised not to seek relief at the Eaux Bonnes unless they can support the penetrating air. The air and waters are best adapted to languid, scrofulous, and phthisical persons, but still where there is left a sufficient power of reaction.

Perhaps the use of the Eaux Bonnes in phthisis may be well summed up as follows, pretty nearly in the words of M. Patissier:—"They may be serviceable in the first stage of phthisis, rarely in the second, fatal in the third." On this point not a doubt should be left.

According to a report of M. Ducalde, the inspector of the springs, in thirty-three cases of phthisis in the first and second stages, the conditions of the patient improved, and the cough entirely disappeared under the use of the waters. In sixteen cases of aphonia there were four perfect cures, whilst others were relieved; and of seventeen patients affected with chronic pulmonary catarrh four were cured, the rest gained flesh and were relieved. In advanced consumption the use of the waters only hastened the fatal termination. The season is from the end of May till the middle of September.

The water is drunk in the morning and at four in the afternoon; and the usual course is to breakfast and dine after each dose. In cases where the waters agree, the effect, with the fine mountain air, and scenery, and

*N Remond impʳ r Vieille Estrapade 15 Paris*

Gravé par E. Wormser

CAUTERETS.

exercise, is to promote the excretions, and vastly improve the appetite and strength.

### EAUX CHAUDES (BASSES PYRÉNÉES).

They are situated between three and four miles from Eaux Bonnes. Quite recently a new road renders the route such between the two places that patients can walk without much fatigue. The village of the Eaux Chaudes is at the extremity of the valley of Ossau, which here forms a sombre gorge of wild aspect. The houses are built on the mountain side, and the thermal establishment is upon the side of the gorge. There are six sources, all sulphurous; the temperature of only one of them, Le Clot, deserves the name Eaux Chaudes, according to the division already made of thermal springs. Its temperature is about 96° of Fahrenheit. Here, certainly, too much importance is attached to the presence of sulphuret of sodium, for that which is said to contain most, Le Rey, has only 0·0098 of a gramme to the litre = 0·086 of a grain to our English pint. Powerful, indeed, must be this substance, if, in such quantities, it possess the properties assigned. Of the other sources, the Mainville waters generally contain half the solids of Eaux Bonnes, of which one-half are sulphates of lime and soda.* The Mailleville has a temperature of 60° of Fahrenheit. The fountain called Le Rey was named after the kings of Navarre, who used it. A handsome establishment, in which all kinds of baths are administered, has succeeded their rude huts. The waters are little used for drinking, which, indeed, their composition would not justify; but much for baths, and especially in rheumatic affections.

Passing over some minor Pyrenean waters, we arrive at

### CAUTERETS (HAUTES PYRÉNÉES),

which has a very considerable reputation. It is 3057 feet above the sea. There is a new road to Cauterets from Eaux

---

* There are also glairine, traces of iodine, and silicates of alumina and magnesia.

Bonnes, by the Col de Forte ; but it is rough and fatiguing, and the invalid had better return to Pau, and proceed from that place. This route is splendid, and possesses very fine prospects. Cauterets is a romantically situated little town in itself; for the country, rather pretty, standing north and south. The waters are, for the most part, truly thermal; and these vary from 86° to as high as 131°. They contain of solid ingredients even less than Eaux Chaudes. Some of the waters contain, however, as much as nearly 0·7 of a grain of sulphuret of sodium in the pint, and a great variety of ingredients in traces, besides salts usually found, as iodine, strontian, glairine, baregine, and ammonia. The sources have the disadvantage of not being in the town itself, but scattered over the environs. There are no less than twelve sources, which are divided into those of the east and south, answering to the position which they occupy with regard to the place. Those of the east (there are six of each) are named Cæsar, the Spaniards, Pauce Vieux, Pauce Neuf, Bruzaud, and Rieumizet.

The sources of Cæsar and the Spaniards are on the top of a mountain called Pic du Bain, from which they are conducted by an aqueduct to the baths, constructed on a level, by the thermal establishment. The temperature is 118°. Part of the water goes to the establishment of the town, part to the new establishment of Pauce. The source of the Spaniards has two degrees less of temperature than that of Cæsar.

The baths of the city form an elegant establishment, well arranged. There are two drinking fountains, fourteen douches of various kinds, and a shower-bath ; and twenty baths divided between the sources. Both these sources are considered very exciting. The baths are applied to the treatment of rheumatic affections, skin diseases, and scrofula, and should not be prescribed to a person of irritable habit. The source of Cæsar is much used in drink, and is supposed to be especially suitable to the catarrh of old people.

Of the other sources of the east, the two Pauces are employed almost in the same cases as the Spaniards and the Cæsar ; but they are preferred in skin diseases, and in inveterate affections, aggravated by the use of mercury.

The source Bruzaud, the strongest of all, and which at its exit is nearly as sulphurous as that of Cæsar, is conducted, at some distance from the bath of the town, into a small building, but its traverse is managed so badly that, before its arrival, it has lost its sulphuration. It is, therefore, less excitant than the others, and is prescribed in difficulties of the abdominal circulation, and in some female diseases, and is administered especially in baths, and ascending douches. Temperature 118°.

Rieumizet is a source without importance. There are thirteen baths in the establishment, but no douches.

### SOURCES OF THE SOUTH.

There are six: La Raillère, the smaller St. Sauveur, Le Pré, Mahourat, Les Œufs, and Le Bois.

La Raillère is the source the most renowned in Cauterets. It is situated at twenty minutes' walk from the town, from which there is a good road, in a handsome building, which has twenty-three baths, a douche, and a drinking fountain. It is very much frequented. The water is abundant and limpid, and has a sweetish taste, and a temperature of 102°.

It is prescribed, like the Eaux Bonnes, in catarrhal and tuberculous affections of the organs of respiration, and what has been said of the precautions in the use of the Eaux Bonnes applies to it.

The waters of La Raillère are less active and less excitant than those of the Eaux Bonnes, as they are also less sulphurous. The Eaux Bonnes act more particularly on the lungs ; those of La Raillère are more diffuse. Hæmoptysis is more frequent at the Eaux Bonnes. This is supposed to be due to the frequency of bathing at La Raillère, which the abundance of the water allows ; whereas, from the scanty supply at Eaux Bonnes, this is not possible ; consequently, at the latter place, there is no revulsion to interfere with the concentrated action of the remedy on the lungs, but there are great difficulties in the way of this view, for, in fact, hot bathing itself has been considered dangerous in hæmoptysis from its effect on the circulation, for, increasing the heart's action, and frequency of the pulse, it tends to send the blood more forcibly to the lungs, and, therefore, might be supposed more likely to cause effusion of blood from the weakened pulmonary tissue.

A remarkable fact exists, which may tend to show that the cures effected by mineral waters occur every year at La Raillère. Every year a number of horses are brought to Cauterets affected with obstinate chronic bronchitis, want of appetite, diarrhœa, and leanness. These are the stallions of the Government horses from Tarbes and Pau. These animals drink the waters of La Raillère with great avidity, and, after a week or so their digestion improves, the cough becomes better, the strength is increased, and the animal becomes strong and well.

The Little St. Sauveur is a weak water as regards sulphur, but contains much baregine. In temperature it is like our Buxton, having only 84°. It is believed to be useful in irritable nervous affections, and in female discharges. It is used in baths and douches.

Le Pré has a high temperature, and contains a moderate amount of sulphuret. It is only used in some slight rheumatic affections.

Mahourat. A small fall of water at the temperature of 120°, which is collected in the crevice of the rocks. It is slightly sulphurous. It is celebrated throughout the country in affections of the stomach, which is the reason that a crowd of country people is gathered there daily. When the waters of La Raillère cannot be borne by the stomach, those of Mahourat are associated with them.

Les Œufs. This is above the cascade called Mahourat, which is opposite the source of the same name; its temperature is 138°; degree of sulphuration very moderate. This is the hottest source, and is called so because it can boil an egg. A rock which rendered it almost inapproachable has been blown up, and it falls into a natural basin of granite.

Le Bois is a pretty little establishment raised on the top of a rock which dominates the valley. There are four bathing closets, and two open baths, with douches. It is nearly two miles from Cauterets. Its temperature is 98°, and feebly sulphurous. It is supposed to suit better nervous rheumatic affections of interior organs, in consequence of the disease being driven internally.

Dr. James says, with great truth, that the distinctions drawn by the medical men of the place with regard to the particular diseases in which these waters are used appear to him to be too fine. The waters are all of them of the same character, and such as in this country would be regarded as exceedingly weak both in sulphur and solid ingredients, but for their thermality. Great success has been obtained by Dr. James, at Cauterets, by directing a shower alternately of hot and cold mineral water upon the spinal column, and by ascending douches in uterine diseases. The waters of most of the springs are powerful stimulants, and require much care in their administration. In health the weaker ones are tonic, while the stronger induce feverishness. According to Orfila, La Raillère is useful in bronchial catarrh, in the first stage of phthisis, and accompanying hæmoptysis, in neuralgic affections of the chest, and gastralgia ; the Pauce, in chronic rheumatism, and in skin diseases, in asthma attended with expectoration, and in lymphatic diseases ; Bois and Pré chiefly in rheumatic affections; Petit San Sauveur in uterine affections. Of 6238 cases treated at Cauterets, 2030 were cured; 2998 relieved ; and 1305 treated without success, or rendered worse. Of 70 cases of phthisis of the windpipe none were cured, but 15 were relieved. Of 240 cases of pulmonary phthisis in the first stage none were cured, 68 relieved.

At Cauterets there is nothing approaching to a Kursaal ; the environs are beautiful, but many of the roads are detestable.

## SAINT SAUVEUR (HAUTES PYRÉNÉES),

More than 2300 feet above the sea level, is reached from Pierrefitte by a road boldly cut in the rock, along a *gave* with stupendous precipices, where there is nothing to be heard but the sound of the torrent below, or to be seen but the sky, as a kind of star above. On every side arid schistose mountains without signs of life. The place is, in a manner, suspended in the middle of the mountain of Aze. The rock was blown up by gunpowder to form space for the existing village.

The source springs from a rock in front of the baths, to which it is conducted by marble conduits. It is clear, limpid, and oily to the taste and touch. Its temperature is 93°. It is considered very sulphurous, but, in reality, the quantity of solid matters of all kinds is very small. It is chiefly used for catarrh of the bladder, and female affections; but does not seem to offer many inducements to the stranger to reside there, when there are watering-places so superior in character.

## BARÉGES (HAUTES PYRÉNÉES).

Baréges is 4000 feet above the sea; about sixteen miles from Luz, on the left bank of the Bastan, an impetuous torrent, and in a wild and savage spot. It is neither a town nor a hamlet, but rather a kind of camp, although there are some good houses. In the middle of the long street which forms Baréges, instead of houses there are wooden barracks, which are taken down at the end of each season, and put up anew the following spring. The reason is, that during the winter the spot they occupy will form the bed of avalanches; the pic of Ayré, covered with strong beeches, protects the rest of the village against the fall of these, and an ancient law punished with death any one who should injure the trees.

Baréges dates its fame from the period of the visit of Madame de Maintenon to it with the young Prince of Maine in 1675. The boy was of a feeble constitution, and had a club foot; the waters strengthened the former, but did not cure the latter.

The waters are limpid, and taste and smell sulphurous, leaving a strong *arrière goût.* The substance called baregine was first observed in them, and named from the place of its discovery. There are no less than nine sources, eight of which are within the bath establishment, the other on the road to Luz. The last is called Barzun. The eight others are named Le Tambour, L'Entrée, Polard, Bain Neuf, Le Fond, Dassieu, Genecy, and La Chapelle. They are ranged according to their temperature, the highest being Le Tambour, at 45° Cent., or 118° Fahrenheit; and the lowest La Chapelle, at 31° Cent., or very nearly 88° Fahrenheit; they also rank, with the exception of Polard and Bain Neuf, nearly in the order of the amount of sulphuret of sodium which they contain: Le Tambour having to the litre 0·0404 of a gramme, or as nearly as possible 0·354 of a grain to the imperial pint, and La Chapelle about half that quantity; while the total solids are only 1·738 of a grain.

The waters of Baréges have a high reputation for the cure of old wounds, and an hospital is established there for soldiers, and particularly those exhibiting masses of what is generally termed proud flesh. The loose spongy flesh acquires a firmer consistence, a pellicle forms on it as if it had been cauterized. This pellicle scales off, a new one forms under it, and in this manner the exuberant flesh is reduced. The waters of Baréges are also celebrated for their cure of all kinds of wounds and contusions.

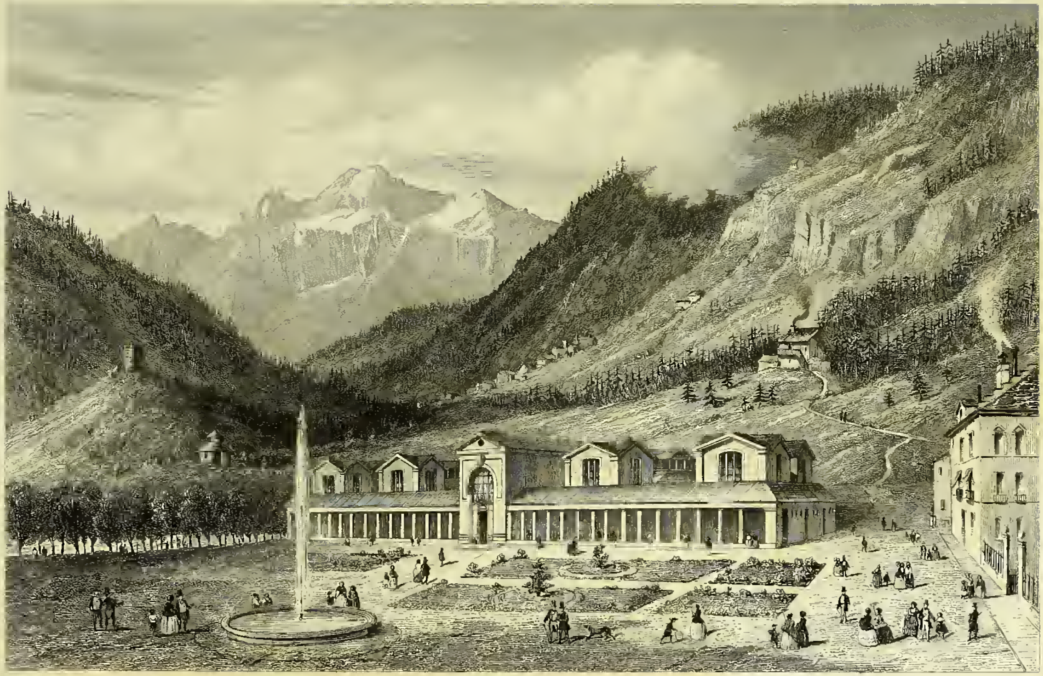
The waters of Baréges have a much greater reputation in the cure of old wounds than those of Luchon. This has been ascribed to the sulphurous principle being more fixed at Baréges, in the form of sulphuret of sodium, while at Luchon a good deal of it is in the form of sulphuretted hydrogen. Nay, it has been maintained that the superiority of Baréges may be due to the practice which prevails there of bathing in common baths rather than in private ones. Many physicians at mineral waters maintain the greater efficacy of the former mode. A wound continually moistened by a current of fresh water may receive more benefit than when the water is stagnant.

Contractions of the tendons, palsy of the lower part of the body, mercurial affections, skin diseases, are among the diseases cured at Baréges. They are the reverse of useful, it is said, in rheumatic affections, whose intensity they excite. The waters of Baréges are not so successful in rheumatism affecting the joints as in the rheumatic and other forms.

Great care is requisite in the management of these baths, which often excite the pulse, produce headache and febrile symptoms. Dr. James remarks that a bath at Baréges will produce infinitely greater effect than an artificial sulphur bath containing twenty times as much sulphur. The water at Barzun has the same temperature as La Chapelle, and is sometimes used as a preparation for the baths at Baréges as less exciting. Baréges is not likely to be frequented by our countrymen, on account of the want of proper convenience at the baths, and of accommodation in the place; and besides the climate is exceedingly changeable.

### BAGNÈRES DE LUCHON (HAUTE GARONNE),

Which was known to the Romans as *Aquae* Balneariae Luxonienses, is situated at an elevation of 2000 feet, in a magnificent valley in the Pyrénées, about eighty-five miles from Pau. The town is handsomely built, and there are commodious lodgings for strangers. There are no less than forty different sources—all sulphurous except one. The highest of these in temperature, as at Baréges, also contains the largest quantity of sulphuret. This is the source called Bayen, which has a temperature of 154·4° of Fahrenheit, and contains 0·0777 of a gramme to the litre, or 0·68 of a grain to the pint, of sulphuret of sodium, while the lowest of these sources in temperature, Ferras Superieur, No. 2, has a temperature of only 92°, and the amount of its sulphuret



N. Remond impr r. Vieille Estrapade, 15 Paris

Dessiné et Grave par E. Wormser

BAGNERES-DE-LUCHON.

is the lowest, as at Baréges with La Chapelle, being rather less than one-half that of Bayen. This coincidence is striking, and would seem to indicate a common origin of the thermal heat and the sulphur. The solid constituents are about a third more than those of Baréges, consisting, at the fountain of La Reine, taken as the type of the rest, of sulphates, muriates, and a trace of carbonates of soda and lime. It is needless to particularize such minute quantities. These sources as they come from the pipe are limpid and colourless; exposed to the air, they change colour, and become finally lactescent. This change can be produced by adding some of the fountain La Blanche to La Reine, and the transparency restored by the further addition of the water of La Grotte. This phenomenon is owing, it has been supposed, to the action of the silex (silicic acid) which exists in the mineral water decomposing the sulphuretted hydrogen, which precipitates sulphur. The waters of Luchon contain also traces of copper. Besides sulphuret of sodium, they contain also minute quantities of hyposulphite of soda, of iron, and of iodine.*

The waters of Luchon are derived from granitic and micaceous-schistose rocks; the supply is abundant. They are enclosed in numerous solid vaulted galleries, which represent a length of 1100 yards. The thermal establishment is on a very different scale from that at Baréges. It is built upon the site of the ancient Roman baths. It is composed of eight pavilions, containing private baths, common baths, douches, and vapour baths. A ticket placed over each pavilion indicates the sources whence it is supplied. Where a source is too feeble of itself to furnish a sufficient supply, it is united in a reservoir to others.

The waters are used externally in every variety of mode, and drunk in doses of three or four glasses, pure or mixed with milk.

These waters are very similar in their effect to those of Baréges. They are used in chronic rheumatism, scrofula, ulcers, fistulous wounds, and diseases of the bones. As the waters of Baréges have a special reputation for the cure of old wounds, so those of Luchon are famed for their beneficial effects in skin diseases.

---

* I have not, in the analytical tables by me, a statement of the amount of free sulphuretted hydrogen in the waters of Luchon.

Mercury has no effect upon the mouth when a patient is taking the waters of Luchon; and patients arriving there with mouths sore from the previous action of mercury, rapidly recover.

In the neighbourhood of Luchon (Haute Garonne) are to be seen many of the strange and miserable race called Cagots, who form a great contrast with the general healthy aspect of the people. They are characterized by their sloping foreheads, flattened faces, gaping jaws, dull and staring eyes, guttural voice, and generally, like the Swiss cretins, by the presence of a goitre. Whether they are a peculiar people, or if so, the remains of what people, has been and is a matter of conjecture; the aborigines, Goths, Saracens, have all had the honour of the paternity.

The Eastern Pyrénées contain many sulphurous waters which spring from the primitive or transition rocks. Some of the more recent formations yield waters more charged with carbonates.

Vernet, a little village at the foot of the mountain Canigou, about thirty miles from Perpignan, has thermal springs, which were used by the Romans. The principal sources are that of the ancient Thermæ, having a temperature of 137°, that called Elisa 91·5, and the fountain Comtesse, which is not tepid, having only 48° or 49°. The waters are very feebly charged with solids and sulphuret of sodium. The establishment of the baths is well arranged, and at the Hotel les Commandants there is every accommodation. Here Ibrahim Pacha resided. By means of pipes fed by the thermal water, the apartments are kept at a comfortable warmth in winter, so that the waters can be taken at all seasons. They are kept at a temperature of from 54° to 59° in winter, and several phthisical patients, on account of this comfort, pass the winter at Vernet. There is another large hotel with baths, as well as that of Les Commandants.

## AX (ARIÉGE),

Stands at the confluence of the Ariége and the river Ascuo. It is a small town situated on a soil from which sulphurous waters everywhere spring. There are as many as fifty-three springs, which are mostly divided between three thermal establishments. Many of them, however, run to waste in the streets, and are employed either in various domestic uses, or in cleansing wool. The physical and chemical properties are nearly those of Bagnères de Luchon. They furnish abundant sulphurous incrustations, and change colour in the baths, becoming blue instead of white. The two most sulphurous sources are the Canons and the Rossignol: they contain about one-fourth of a grain of sulphuret of sodium in the pint. The temperature is 167° for the former, and 170·6° for the latter. Some of these waters contain baregine, and others not. From the number of the sources, at different temperatures, baths may be given at almost any temperature. They are well adapted to form sudatories, as they readily emit their sulphuretted hydrogen. The great want of Ax is in suitable establishments, and accommodation for invalids. A traveller says—"The reason why Ax has not become a place of much more consequence than it is, to which it is entitled by the picturesque scenery in its vicinity, the beautiful walks and rides which surround it, its mineral springs and baths, and its easy access, is altogether owing to the want of spirit and enterprise among its inhabitants, displayed in the almost total disregard which they evince in providing for the accommodation of its visitors."* Things are not changed now. There is a Government thermal establishment for invalid soldiers in the place.

---

* "A Summer in the Pyrénées." 1842.

### AMÉLIE LES BAINS (PYRÉNÉES ORIENTALES)

Is situated on the right bank of the Tech, about two miles from Arles, and eleven and a half from Perpignan. The village was formerly called Bains-près-Arles. There are numerous thermal sulphurous springs, which are all of high temperature, varying from 141½° to 109°; the former is the temperature of the spring which supplies the baths Hermabessière at the pipe, the latter that of Maujolet, where it is drunk (buvette) while the temperature of the common swimming-bath is 103°.

These waters contain rather more fixed principles than those of Baréges or Luchon, with a minuter portion of sulphuret of sodium still, and 0·0247 of a cubic centimetre of sulphuretted hydrogen to the kilogramme, a quantity so small that it is not worth while reducing it to English measure. Of the 1·72 grains in the pint of solids which they contain, a considerable portion are carbonates, with some free carbonic acid, hence they give a precipitate with lime water, which others of the waters of the Pyrénées do not.

Almost all the sources are the property of private persons. There are two sanatoria belonging to Doctors Pujade and Hermabessière. The waters are chiefly employed in skin diseases, rheumatic affections, scrofulous tumours and ulcers.

The establishment of Dr. Pujade is amply provided with every kind of bathing apparatus. The sulphurous odour can be felt in the corridors and on the stairs. By means of the stoves, a warm humid atmosphere is kept up, so that during the winter the patient is transported into an artificial climate as it were. Such an atmosphere might be found very beneficial in phthisical cases.

A military establishment has been erected, nourished by the copious source called Escaldadou, of the same temperature as that named Hermabessière.

Olette.—The sources of Olette are situated not far from Vernet, on the road from France to Spain, by Puycerda. Some of them have a temperature as high as 172° of Fahrenheit, others are not even tepid. They contain small quantities of sulphuret of sodium. There are several minor sources in the Pyrénées, but no establishment has been formed at them, nor even at Olette, although it seems as worthy of being so employed as some others. It is here, as with us in England, there are a great many waters believed to possess medicinal qualities equal to those of spas in vogue, but either something which cannot be got at in the water, or fashion and custom, or the situation of the place, or a long-continued belief in the virtues of other spas, prevents them coming into use, and restricts every one to the reign of the older and more established waters. According to Anglada, some of the waters of Olette have undergone a considerable diminution of temperature. In 1757, according to an examination, there was a difference of 27° Reaumur, from what he found sixty-five years after.

## SALINE WATERS OF THE PYRÉNÉES.

The Pyrenean waters hitherto described have all been sulphurous. There are others which are merely saline, invariably connected in position with feldspar, amphibolic, and pyroxenic rocks, the lines of appearance of these rocks being always those whence waters, more or less thermal or acidulated, arise. These waters may be divided into the simply saline, or those containing sulphate of lime as well. The former pass into the latter by degrees. There are numerous minor waters of this kind:—Audinal, thermal and ferruginous, used in chronic visceral affections. Astus, ferruginous, and charged with salts of magnesia, feebly tepid. Capvern of a similar character. Miadan-Encausse, somewhat stronger in salts; temperature slightly above the average of waters, and of a somewhat bitter taste, and which have been recommended in nephritic and bilious colics, jaundice, and abdominal tumours; and it is said that they have cured intermittents which resisted other remedies. There are several of these minor saline springs.

### USSAT (ARIÉGE).

The mineral waters of Ussat are in the Department of the Ariége, a few leagues from Foix. They are situated at the foot of an immense precipice on the borders of the Ariége. They spring from a shifting and porous ground, which has necessitated the employment of extensive engineering labours to protect them against the encroachments of the river. The mode of bathing here was formerly of the rudest possible description. The bathing establishment, which has only one story, now possesses forty handsome baths, constantly supplied by pipes from a reservoir. There are also two common baths, and a complete system of douches. The building, placed against the mountain side, has a length of more than a hundred yards; as the water enters a pipe which supplies the baths in succession as it passes along, the water at the lower baths is less warm than at the upper, so that baths can readily be had of any temperature from 104° to 89°, according to the position of the baths. These waters contain, according to one analysis, 11·4 grains of solids in the pint, of which the chief ingredients are sulphates and carbonates of lime and magnesia, with a little chloride of sodium, and traces of arsenic. In the bath they disengage bubbles of azote. They are chiefly employed in baths, and are soothing and sedative.

They are chiefly used in certain nervous affections of females—now called neuralgic, formerly the vapours. They are also employed in cases of certain female irregularities, and with the best effects. Those, too, who suffer from nervous affections, the result of over-study and anxiety, derive great benefit from these waters.

There is good accommodation in hotels and private lodgings. The neighbourhood abounds in fine scenery, and offers great attractions to the geologist. There are natural grottoes with gothic and arabesque arches, and curious stalactitic formations; and there is much sociability at the place.*

---

* This water very much resembles Bath, except in the lower temperature of the water.

### BAGNÈRES DE BIGORRE (HAUTES PYRÉNÉES).

This celebrated watering-place is situated about ten miles from Tarbes, in the middle of splendid scenery, and sheltered by mountains, so that it enjoys a favourable climate. Some of the sources contain nearly four grammes in the litre, or about thirty-four grains in the pint, which is more than most of the celebrated fountains of France. The source La Reine, contains in the pint, of solids—

23·67 grains.

17·60 sulphates of lime, soda, and magnesia.
6·07 chlorides of sodium and magnesium, carbonates of soda and lime, silica, and iron; also a fatty resin, and traces of arsenic.

Of the sulphates no less than 14·70 are carbonate of lime.

In all the waters the sulphate of lime predominates; but some of them contain iron, of which others have none: they are, therefore, divided into ferruginous and simple salines.

Of six sources which feed the thermal establishments of the town, five are ferruginous, viz., La Reine, Le Dauphin, Roc de Lannes, Saint Roch, and Les Yeux. The Foulon is not so. Many others in the hands of private individuals are ferruginous. The whole town is full of sources of thermal waters; they can be found almost anywhere by boring. Near the town there is a cold chalybeate.

The iron waters of Bagnères have stimulating properties.* They are useful in melancholic habits, and in men weakened by sedentary pursuits and anxiety of mind, as literary men often are. They are also useful in general debility, in green sickness, and generally to young and delicate females. The cold chalybeate already spoken of is useful as an auxiliary means. The saline matters differ from the preceding almost solely by the absence of iron, which, however, exists in the others in such minute quantity that they do not deserve to be called chalybeate. All these waters disengage oxygen, carbonic acid, and azote.

---

* M. Patissier has lately proposed (*La Revue Médicale*, Avril 30, 1857) to divide mineral waters into *hyperthenisantes* or excitant, and *hypothenisantes* or sedative. It is difficult to see the advantage of such a division, which is far too crude.

The temperature of all the waters varies from 124° to 84°. The saline waters are considered rather calmative than excitant. The Foulon has hardly any iron or calcareous salts. Its temperature 91·5° of Fahrenheit; and the small quantity of the minerals which it contains renders it essentially sedative. It has been employed in rheumatic neuralgic affections, in nervous palpitations, and in some skin diseases, where the hotter and more mineralized baths would be too excitant. Its supply is not abundant, and there is a struggle night and day for the four baths which are supplied from this source. La Salut, of a somewhat lower temperature than the Foulon, is used like it as a calmative. At the Salut, as at the Foulon, the bather is in an equable temperature, and in a current of mineral water constantly renewed. The water of the Salut is much used internally, and is supposed to be especially beneficial in allaying irritations of the mucous membranes, of the digestive apparatus, and of the bladder; hence it has been much praised in gravel and catarrh of the bladder.

Labassière is six and a half miles from Bagnères, at the foot of the valley of Trébons. Its water is strongly sulphurous, and also contains a large proportion of chloride of sodium. Its chief use is in catarrhal affections.

# CHAPTER X.

Mineral Waters of the Centre of France.—Chiefly situated in Auvergne.—Mostly of volcanic origin.—Mont Dore.—Village of Les Bains.—Effects of the Baths.—Waters contain arsenic.—Cure by inhalation.—Royat. — Saint Allyre. — Chateauneuf. — Chateldon. — Chaudes Aigues.—Vichy.—Its numerous sources.—Their contents.—Active principle the carbonate of soda.—Their tendency to render the fluids alkaline.—Diseases of the digestive organs; of the liver.—Gravel and urinary calculi.—Gout and rheumatism.—Diabetes and Bright's Disease of the Kidney.—Neris.—Bourbon l'Archambault.—Bourbon Lancy.

## MINERAL WATERS OF THE CENTRE OF FRANCE.

THESE are especially situated in the old province of Auvergne and the Bourbonnois, which is a vast granitic mass, pierced by secondary porphyries and volcanic rocks. The number of these springs is very great, and in general they are thermal: some of them even approach the boiling point. While the region of the Pyrénées contains sulphurous waters in abundance, the centre of France contains chiefly salines, sulphates, bicarbonates, chlorides, and silicates; the chief base is soda, then magnesia, and they abound in carbonic acid gas.

### MONT DORE (PUY DE DÔME).

The valley of Mont Dore is one of the most curious and picturesque portions of ancient Auvergne. Earthquakes, craters, and currents of lava attest that, in remote ages, these countries now so peaceful and fertile, were the seat of frightful convulsions. The road from Clermont is not less frequented by tourists than by invalids. The village termed Les Bains is situated in a valley traversed by the Dordogne, which is here only a small brook, and almost lost in a rocky ravine. It is on the right bank at the mountain of L'Aigle that the sources arise, 3400 feet above the sea. There are seven, of which all are thermal, except the one called the fountain of Sainte Marguerite: this has a sharp acid taste owing to the carbonic acid which it contains. Its temperature is 52°. It forms a pleasant drink when mixed with wine. The six thermal sources are Le Grand Bain, the Source of Cæsar, the Fountain Caroline, the Bain Raymond, the Bain de Rigny, and the fountain La Madeleine. All these are in the establishment, which is built of lava on the very spot where the waters arise. This is a model of its kind, and consists of three long squares, successively smaller, terminating in a pavilion, and connected by long galleries, and called the peristyle, the grand saloon, and the pavilion. The peristyle, on the ground-floor, contains in its central part two vast common baths, with douches for the poor. The grand saloon, on the first story, has nine cabinets on each side; the right for men, the left for women, with all the apparatus necessary for shower-baths.

At the end of the grand saloon is the pavilion. In the same enclosure, but on a higher plane, so that it is ascended by fifteen steps, there are ranged five baths and five descending shower-baths.

The temperature of the great bath is 104°—108°. The source of the Cæsar rises in a kind of crypt, a work of the Romans. It is mixed with the waters of the Caroline, and has a temperature of 113°. The Bain Raymond, and the Bain de Rigny, discovered among the Roman ruins in digging the foundations of the actual baths, furnish the baths of the peristyle: temperature 109°. The fountain of the Madeleine is the hottest of all, having a temperature of 114°. It is exclusively used for drinking. As each of these springs leaves the ground it seems to boil with excess of carbonic acid. The supply of water is sufficient for seven or eight hundred baths daily. An additional establishment has been lately constructed for vapour baths, and inhaling the gas.

The waters of Mont Dore are limpid; they have no smell, but an acid saline taste. Exposed to the air they become covered with an iridescent pellicle, formed of organic matter, carbonate of lime, and silica.

The reputation of these waters is very ancient, and they are mentioned by Sidonius Apollinaris, as "Phthisisicentibus medicabiles."

They contain the same principles in different proportions; the Madeleine 1·260 grammes of solids in the litre, of which

| | |
|---|---|
| Carbonate of soda | 0·386 |
| Carbonate of lime | 0·237 |
| Chloride of sodium | 0·296 |
| Sulphate of soda | 0·126 |

Insignificant traces of iron and alumina.

The water of the Madeleine is strongly arsenical, and M. Thenard is of opinion that the waters owe their activity to this principle.

The baths produce a powerful effect on the frame; the skin colours, the pulse becomes frequent, and profuse perspiration takes place. The patient is removed from the bath when the attendant physician thinks that the effect has been produced, and at once taken to a well-aired bed.

Besides the baths, the water is drunk—three or four glasses daily. The effect is greatly to stimulate the perspiration, and, at the end of a few days, the bath fever makes its appearance. The patients experience a sensation of lassitude, with dryness of the skin, and constipation; laxatives are often required; the patients then have violent sweats. Often old wounds break out, or old fluxes return, or an eruption makes its appearance.

Great use is made at Mont Dore of the cure by inhalation. The watery vapour is made to pass into rooms where the patients respire. According to the observation of Thenard, they do not merely get water and carbonic acid in this way, but particles of sea salt are carried up by the vapour, as was remarked to be the case with sea air. The waters are chiefly used in affections of the chest, but as they are too stimulating, for many patients it will be well to commence with the temperature of the waters at 70°, and gradually increase it.

Of the affections for which these waters have been recommended, the first class in importance is phthisis. In cases where the disease has proceeded to suppuration, and where there is spitting of blood, with a quick pulse, profuse sweating, and such like symptoms, benefit can hardly be expected. But where the pulse is slow, and the tubercles have not proceeded to suppuration, and where there are all the signs of debility, then the waters may do good. Indeed, it may be remarked that neither cod-liver oil, nor syrup of the iodide of iron, nor any of the usual remedies will do good in phthisis while the pulse is quick. I always, in such cases, have been accustomed to reduce the pulse by digitalis and sulphuric acid, and to conjoin this treatment with counter-irritation.

In chronic pulmonary catarrh, and especially in asthma, these waters have a high reputation, which may be owing to the arsenic, for this substance has long enjoyed a reputation for its anti-asthmatic properties.

The walks around Mont Dore abound in picturesque scenes. The mountains of Auvergne enjoy a great reputation, that of Sency is the highest in central France, having an elevation of 6155 feet. A season at Mont Dore only lasts fifteen or sixteen days. The waters continued longer are too excitant.

### BOURBOLE (PUY DE DÔME).

About two miles from Mont Dore, upon the right bank of the Dordogne, at the foot of an immense granitic rock, is this little village. The waters spring up in the midst of a Roman bath: they are very saline, and have a temperature of 126°. They contain salts of soda, chiefly the chloride, lime, and iron, and are likely to be beneficial, especially in scrofulous affections; but there is a want of accommodation at the place.

### SAINT VICTOIRE (PUY DE DÔME),

Is situated about ten miles from Mont Dore, in a country remarkable for its picturesque scenery. There are many sources, which vary in temperature from 64° to 104°. When they come from the rock they are clear, but some, on being exposed to the air, deposit a sediment composed chiefly of calcareous salts ; they are alkaline and gaseous, and contain sulphuretted hydrogen as well as carbonic acid. The waters have been used chiefly in female affections, catarrh of the bladder, gout, and gravel.

### ROYAT (PUY DE DÔME).

Near Clermont, on the left of the road, is the little village of Royat, where, two or three years ago, in clearing out the *débris* of ancient Roman baths, these waters were discovered, and promise to be of considerable utility. They have a temperature of 97°, and are gaseous, alkaline, and ferruginous. Extensive baths have been constructed: the chief use of these waters would be in diseases of debility ; four or five glasses, taken at intervals, is the dose. The carbonic acid is disengaged in such quantities as even to have caused serious accidents.

### SAINT ALLYRE (PUY DE DÔME),

Rises in a suburb of Clermont. It has a temperature of 75° ; it contains a large quantity of carbonate of lime, and deposits this on substances put into it. The springs have formed a great mass of travestine.

Chateauneuf is placed on the banks of the Rioule, and twelve miles from Clermont. There are several springs whose temperature varies from 59° to 100°. The waters are gaseous, alkaline, and chalybeate.

Chateldon, also twelve miles from Clermont, of a similar character, but not so saline. They resemble Seltzer water much, and are used as a substitute.

### CHAUDES AIGUES (CANTAL).

Twenty miles from Saint Flour are these waters, the hottest in France. The fountain Par has the highest temperature; it is between 177° and 178°. The chemical element is very feeble in these waters, and the inhabitants use them freely for domestic purposes, which causes such an economy of fuel, that it has been calculated that they hold the place of a forest of oak 500 acres in extent. They have been used for artificial hatching. They have been given chiefly in rheumatic affections.

### VIC SURCERE (CANTAL).

About nine miles from Aurillac. These waters are not thermal, their temperature being only 48°. They are valuable waters, containing alkaline carbonates, chlorides, and salts of iron. The following is their analysis. In a litre—

| | |
|---|---|
| Dry bicarbonate of soda ............... | 2·135 grammes. |
| Chloride of sodium ...................... | 1·550 |
| Crenate of iron ............................ | 0·030 |

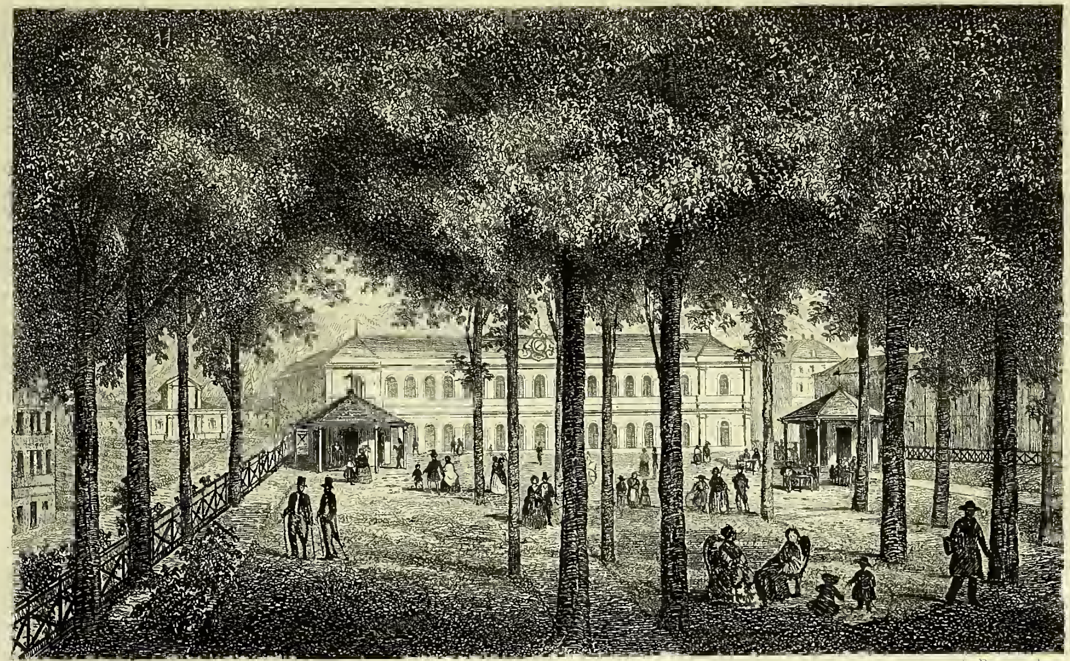
And some other alkaline salts.

These are much used in catarrh of the bladder, in irritation of the stomach and bowels, and in gravel, in green sickness, and generally in diseases of debility. The country offers numerous picturesque sights.

### VICHY (ALLIER).

We now come to a spa whose properties are *sui generis*, uniting the most rare and valuable qualities. Vichy is unapproached and unapproachable, not only in France, but perhaps in the world. As Dr. James has paid especial attention to those waters, and made them the subject of a separate treatise, I shall make no scruple in translating his very admirable description.

Vichy is situated on the right bank of the Allier, and divided into two parts, the old and new town. The old, nearer the river, is composed of ill-built houses and narrow streets. The new is separated from the old by a long Place planted in avenues, and is distinguished moreover by the elegance of its buildings, which represent immense hotels where the patients live. It is at the extremity of this portion



Perrassin del

de Bar sculps

VICHY.

of the city that the baths occur, which can strive with any on the Rhine.

The principal sources of Vichy are eight in number. The bicarbonate of soda predominates so in their composition that it is impossible not to regard it as the essential element of their mode of action. In this respect the therapeutic effect agrees with the analysis, for the strongest sources of Vichy are those which contain the most alkaline salt. The quantity of this salt in a litre is indicated below:—

| | | | | | | |
|---|---|---|---|---|---|---|
| Grande Grille . | 106° | bicarb. soda | 4·88 | grammes | 42·80 | grains to the pint. |
| Puits Chomel . | 108° | ,, | 5·09 | ,, | 44·44 | ,, |
| Puits Carré ... | 113° | ,, | 4·89 | ,, | 43·47 | ,, |
| Lucas............ | 84° | ,, | 5·00 | ,, | 43·80 | ,, |
| Lardy............ | 77° | ,, | 4·10 | ,, | 35·38 | ,, |
| Hôpital ......... | 87° | ,, | 5·02 | ,, | 43·80 | ,, |
| Celestins ...... | 84° | ,, | 5·10 | ,, | 44·77 | ,, |
| Brosson ......... | 77° | ,, | 4·85 | ,, | 42·53 | ,, |

So that the source richest in bicarbonate of soda is that of the Celestins; the least rich is the source Lardy. The identity of the composition of the Grande Grille, of the Puits Chomel, and the Grand Puits, leaves no doubt that these three springs proceed from the same source. For the rest, all these sources offer great analogies to each other, and the influence that they have exercised the one upon the other during the continuance of the works which their respective managements have required, is the proof that there exist subterranean communications.

A new source has been discovered, called Puits des Dames, which springs at about twenty minutes' walk from the town, on the road. It contains 4·01 grammes of bicarbonate of soda to the litre.

If in these results of analyses I have only mentioned the bicarbonate, the reason is that the other elements, such as iron and arsenic, exist in so feeble a proportion in these sources, that we cannot point out the mode in which they exert an action; nevertheless, they have a very real value. Dissolve in a litre of ordinary water, the same quantity of alkaline salts which have been seen to exist in Vichy water; this artificial water will very much fatigue the stomach, and you will not obtain such prompt and sure effects as with the mineral water, especially when drunk at the source. Vichy water is not, then, solely an alkaline solution; there is either in the principles revealed by analysis, or in others yet unperceived, a combination which escapes us, but whose existence we cannot for that reason disregard.

The water of all the sources of Vichy is limpid. It exhales no odour, and has a slight alkaline taste. That of the Celestins is rather sharp and *piquant.* The great quantity of carbonic acid that these waters contain simulates in escaping a true ebullition. This gas is quite pure.

There exists also at Vichy a sufficiently notable proportion of that gelatinous and filamentous matter that is found in most mineral waters. It is at the source of the Hôpital that it appears most abundant; they are even obliged to clean once a week the basin where this source escapes, for a thick deposit of this substance forms at the bottom.

Now that we know what are the principal physical and chemical properties of these waters, let us proceed to consider what are their medicinal properties.

The Vichy waters, taken in baths, or drunk—and ordinarily they are administered at the same time in both these forms—exercise upon the entire system an action which, purely tonic at the beginning, would become debilitating. Like most mineral waters, they determine, often at the end of a few days, contractions, agitation, sleeplessness, want of appetite, in a word, those different symptoms which characterize the thermal fever. This, however, is soon dissipated, and, by a happy reaction, the organs begin to act more together, and with energy. It should be added that there are many patients in whom this fever does not exist, and who, nevertheless, receive benefit from the treatment.

So much for the general phenomena. We should aid the wholly specific action that the mineral water exerts on the vitality of certain organs; an action which should not be overlooked, as it has much to do with the effects of the treatment. The subject will be returned to.

Let us consider what are the chemical modifications that the economy will receive from the absorption of a water so charged with bicarbonate of soda as that of Vichy.

The different liquids which circulate in our vessels—these go out, either to be rejected or to re-enter the circulation—all these liquids present, in the state of health, contain chemical properties which disease often modifies : it is thus that one secretion, naturally alkaline, may become acid, and an acid secretion may become alkaline. Now the waters of Vichy have, for nearly constant effect, not only to increase the alkalinity of the blood, and of the other liquids which are naturally alkaline, but to render alkaline all the secretions naturally acid. We may comprehend what will be the consequence of these metamorphoses, and of these kinds of chemical conflicts. It is evident that every disease which recognises, for points of departure or principal manifestations, too great an acidity of the humours, will be powerfully influenced by the waters of Vichy ; and that, in consequence, the employment, well directed, of this mineral water, may constitute the best therapeutic means.

Mark, also, that the water of Vichy, inasmuch as it renders the blood more alkaline, causes it to lose a portion of its coagulability. It is known, also, that the alkalies attack the albumen and the fibrin, and bring about sufficiently promptly the solution of these substances. If, then, the blood becomes less plastic, moves with more liberty in the canals, and, moreover, if it have acquired the property of dispersing the two principal elements which form the bulk of chronic swellings, are we not on the high road to find out in what way the waters of Vichy are dissolving and absorbent?

But, in impregnating the system with these waters, care should be taken not to pass certain limits of saturation, as the too great alkalinity of the blood may bring on a state of the humours which may cause paralysis of the organic functions, and induce a state of the system such as stamps with a particular seal the constitution of the inhabitants of marshy countries.

M. Barthez causes his patients themselves to test the state of the secretions while he superintends the administration of the waters.

The action of these waters, then, is very complex; it is often difficult to say what belongs to the chemical combinations formed by the mineral waters, or to the physiological reaction of the organs.

It will now be well to pass in review the principal diseases in which the waters of Vichy are most usefully recommended, and also to indicate the sources which appear more proper for the different diseases.

*Diseases of the Digestive Organs.*—Whenever there is debility of these organs, and the mucous membrane of the intestines is too irritable, the waters of Vichy may be used. In general a beginning is made with the Hôpital, as this contains the most unctuous matter; its milder action is generally best supported by the stomach: it should be taken at first in small doses; any imprudence in this respect would only irritate the organs.

In some patients a water quite cold, as that of the Celestins, or of the Ladies' Well, succeeds better; with others the source Lardy, whose temperature serves as a sort of transition between the too hot and too cold sources.

The mineral water does not merely fortify the digestive apparatus, it acts chemically as well on the gastric juices, whose acidity it diminishes. In fact the experiments of M. Cl. Bernard have sufficiently shown what immense influence is exercised on the digestion of animal or vegetable substances by the acid or alkaline state of the different fluids which concur in digestion.

*Diseases of the Liver, and of some other Abdominal Viscera.*—It is especially in enlargements of the liver that results, often extraordinary, are obtained. At the same time that the bile is rendered more fluid, the vitality of the tissue of the liver is excited, the circulation is promoted in the minute vessels, and the whole organ strengthened; these waters are thus powerfully tonic, and relieve obstructions.

Can the waters of Vichy dissolve *gall-stones ?* Probably not, for these calculi are mostly made up of cholesterine, on which the alkalies have no action.* Besides, the stones are imprisoned in the gall-bladder, and it is not easy to see how the water could get at them until they reach the intestine, when they are expelled. To sum up, it is chiefly in enlargement of the liver, without accidental formations or organic degeneration, that the good effects of the waters can be reckoned on.

Enlargements of the spleen and other abdominal organs have also been happily modified by the waters of Vichy; but the cures are more rare than at Karlsbad, Kissingen, or Marienbad. The sources best adapted for the treatment of this class of diseases are the Hôpital and the Grande Grille.

*Gravel and Urinary Calculi.*—Here a distinction must be clearly drawn between gravels formed of uric acid and those of which the phosphates are the base.

The uric acid, or *red gravel,* is the most common of all the kinds. As the alkalies possess the power of dissolving this acid, and as the urine, by the use of Vichy water, becomes quickly alkaline, it is easy to comprehend what may be done with chemical combinations in the treatment of this form of gravel. In fact, the uric acid combines with soda to form a urate of soda, which, more soluble than that acid, is dissolved in the urines, and expelled with them. It is the source of the Celestins which is preferable in this case. It contains most bicarbonate of soda, and it has the best hold upon the uric acid, either to dissolve old gravel, or prevent the formation of new. The *white gravel,* on the contrary, is formed of phosphate of lime, or the ammonio-magnesian phosphate, and it appears the rule that the gravels of this description owe their origin to a urine too little acid to hold in solution the saline elements which constitute them. In this case, should the water of Vichy be ordered ? Certainly not. Instead of dissolving the existing concretions, these waters, in neutralizing by their alkalinity the free acids of the urine, would favour the formation of new deposits, or even would increase the small pieces. It is in such cases that patients render more gravel, the more they drink of Vichy.

---

* Would it not be worth while to try ether as a solvent in such cases ?

It is, then, solely against uric-acid gravel that Vichy possesses incontestable efficacy. Often, indeed, the dissolving action of these waters is so rapid that it begins to be felt with the first few glasses.

Sometimes, however, the waters of Vichy act as a stimulant to the renal apparatus. The gravels, instead of being dissolved by the water, are expelled from the kidney, and carried off afterwards by the urine ; then the patient renders more at the end than the beginning of the cure.

Gravel is often only the first stage of calculi, of which the gravel forms the nucleus or kernel. Once deposited in the bladder, this nucleus grows by the gradual deposition of substances, and forms a stone. Is this also accessible to the dissolving action of Vichy ?

If the different layers of the stone were formed by the uric acid, we might comprehend the possibility of its solution ; the water would act as on the red gravel, only it would take more time. But such is not the usual structure of calculi. They are composed of layers of very different chemical constituents, united often so intimately that it is impossible to know what is the predominant element. If, then, recourse be had to alkalies, you encounter a layer of fresh phosphate, and precipitate more phosphate instead of acid ?

That is the question ; and it is so asserted by M. Petit, who has made very important researches on everything connected with the waters of Vichy.

The different salts which form the stone are never pure, and they do not form a regularly crystallized whole, cemented together in a manner by the mucus and other matters of the bladder, so that there is a combination of animal and earthy matter. The water dissolves the animal matter, and so disintegrates the mass. In the present state of our knowledge of the subject, we must not neglect the means which these alkaline waters offer.* If these waters do not effect the solution of the stone, they appear to relieve pain at least.

*Gout and Rheumatism.*—It is well known that great resemblance exists between the kind of constitution that gives rise to calculous disorders, and to gouty and rheumatic affections. The water of Vichy acts by restoring the tone of the abdominal organs and liver. When there is a tendency in the gout to fly inwardly and attack the stomach, there is reason to believe that the water strengthens the organ, especially if taken along with good French wine. There is a species of gout characterized by great debility, and when the system cannot rouse itself to shake off the disease, the water, taken as above-mentioned, along with generous diet, will be found beneficial in driving the affection to the circumference, as it were, of the system, from the centres. Besides this, in gout there is present in the blood an excess of uric acid and of fibrin ; the one the alkali will neutralize, and it will dissolve the excess of fibrin and albuminous material. The concretions of gout deposited in the joints are composed of the urate of soda, the very substance which the waters of Vichy are most calculated to act upon.

Guy Patin said of gouty people, "Quand ils ont la goutte, ils sont à plaindre ; quand ils n'ont pas, ils sont à craindre." In gout which affects plethoric and robust people, the water, taken between the attacks, modifies materially the state of the system. The water of the Celestins, being the richest in alkali, is preferred. The remedy should not be pushed too far, or a state of debility may result. Of all the kinds of gout, that which occurs in weak habits, not manifesting itself by furious paroxysms attacking the hands and feet, but by a state of general irritation, with shifting pains, is most annoying. All at once a sudden change may take place, and the brain, heart, or stomach be seized with the affection. The alkaline treatment may do harm here. Dr. James prefers, if his patients do not find relief, after a reasonable trial, to send them to Kissingen, Karlsbad, or Marienbad, to Bourbonne, Wiesbaden, Töplitz, or Gastein, to the chalybeate waters of Schwalbach, Spa, or Pyrmont, where the system may recover its vitality.

---

* My friend and former colleague, Dr. Robinson, of Newcastle-on-Tyne, has applied electricity with success to dissolve or disintegrate stone ; but it has not yet been tried in a case, I believe.

It is needless to say that rheumatism, which is cousin-german to gout, finds relief from a similar treatment.

*Diabetes.*—This truly formidable disease should not be confounded with mere ordinary increase of the urinary secretion. The extraordinary increase of the quantity of sugar in the body constitutes it; for this principle—not the sugar of the cane, be it understood—is always present in the body. Grape sugar, or a modification, exists in the liver of all animals, and even in that of fishes. The sweet taste of the livers of some animals, as the calf, is due to this cause. The blood loses its alkalinity, which the waters of Vichy can restore. The probability is, too, that it acts beneficially on the liver, which organ is probably principally affected in the disease. Perhaps, too, it soothes the urinary apparatus, which, although not the primary seat of the disease, exhibits evidence of congestion.

*In Bright's Disease of the Kidney*, the waters of Vichy, of late, have been much prescribed, probably for a similar reason as in the previous disease.

Of late the system of baths has been much improved. Vichy is an aristocratic watering-place; and there is no want of amusements. The waters bear carriage well.

### HAUTERIVE (ALLIER).

A village situated about two and a half miles from Vichy, on the right bank of the Allier, possesses a water charged with bicarbonate of soda and carbonic acid. In composition it resembles the Celestins at Vichy. It is cold.

### NERIS (ALLIER).

This place was frequented by the Romans, and is said to derive its name from the Emperor Nero. Diggings made some years ago, discovered six wells, constructed, in all probability, by the Romans. It is probable that they come from the same source.

In the wells, and at the bottom of the basin, are a number of confervæ, *anabania monticulosa.* It wont grow at a temperature less than 113°. The waters of Neris have a temperature 123°—124°. The plant has a singular mode of growth. It developes itself by digitations, not unlike a frog's spawn, which are united by very fine pellicles. These digitations swell little by little, in becoming filled with azote, like so many minute balloons, which ascend by their specific gravity. Arrived at the surface the bladder swells more and more, and the walls become thinner. In fine, it bursts. The union of these vegetable *débris*, floating at the top of the reservoirs, forms the mud or slime of the bath.

The waters of Neris are simple, oily, and with an insipid taste. Their composition is, in the litre—

| | 1·46 gramme of fixed principles. | | In a pint, imperial grains. |
|---|---|---|---|
| Bicarbonate of soda | 0·42 | ... | 3·62 |
| Sulphate of soda | 0·84 | ... | 7·46 |
| Chloride of sodium | 0·21 | ... | 1·84 |

The gas, which is very abundant, is azote mixed with three per cent. of carbonic acid.

The bathing establishment is not finished, but probably soon will be. There are two large common baths, having a temperature of 92°, and two smaller ones having a temperature of 106°. The two former serve as swimming baths. There is a complete separation between the sexes. There are fifty-two private baths, with shower-baths, &c. There is also a vaporarium where the patients respire the air from the baths of Cacrar. The baths of Baden resemble those of Neris, according to Dr. James. They are recommended in nervous and hysterical cases, where there is excitement of the nervous system, by way of calmative. They are also used in rheumatism, and in skin diseases characterized by unpleasant itching. It is customary to drink the waters as well as to bathe in them. There are not many amusements at Neris.

Saint Pardoux is a hamlet in the department of the Allier, where there is an agreeable gaseous water containing a small quantity of alkaline salts. It is very easy of transportation, closely resembles Seltzer water, and might be used instead of it.

### BOURBON L'ARCHAMBAULT (ALLIER).

The waters of Bourbon l'Archambault were in great vogue in the time of Louis XIV., who himself twice visited them. They are very accessible from Paris. Boileau, Racine, and Sévigné have written of them. But at present they have been deserted for more fashionable spas, as Vichy, Plombières, and others.

The railway, too, is now completed to Moulins, whence, or from Nevers, it is an easy ride to Bourbon. The place has greatly fallen off of late years, owing to the neglect of its waters; and it is not easy for the visitor to find there those comforts which are now to be obtained in general so abundantly.

There is only one hot mineral source, but it is so abundant that it yields 2400 cubic metres of water of the temperature 140°. This source falls into a reservoir, whose base, of Roman origin, serves as foundation to the vault with which Gaston of Orleans caused it to be covered; the inhabitants come and take the water by three large holes, called the Grand Puits. From this cistern two canals go, one for the baths of the establishment, the other serves to supply the Military Hospital. The water, at its source pure and limpid, becomes cloudy on cooling, and is covered with a pellicle of carbonate of lime. Its flavour, decidedly salt; smell like that of several other waters, or bad mutton or veal broth. It contains in the litre 3·980 grammes of solids, of which chloride of sodium 2·240, alkaline bicarbonates 1·244, and alkaline bromide 0·025, as well as some other salts of potash, lime, and magnesia, or about 28·72 of solids to the imperial pint. I may here remark that most of the French waters are far inferior in amount of solids to most of our English spas, but they make up by their thermality and possession of carbonic acid or sulphuretted hydrogen. These waters, besides their thermal quality, contain one-sixth of their volume of carbonic acid.

These waters are chiefly used as baths; there are eight of these on the ground-floor of the thermal establishment lined with hewn stone, and large enough for the bather to take any position he likes, while a current of water is continually flowing. Each bath has a strong shower-bath. In the story above are eight baths of copper with shower-baths, and on the top stage are shower-baths and pumps.

The action of these baths is powerfully tonic and stimulating. About the fifth or sixth bath the countenance becomes more coloured, the pulse fuller and more frequent, the skin hotter, and a crisis declares itself. Sometimes the reaction is so strong that recourse is had to cupping-glasses, or to bullock's horns well suppled, by means of which a man drawing a full inspiration through a hole at the smaller end produces a vacuum. This method is used in China.

The baths of Bourbon l'Archambault are particularly famous in diseases of the bones and ligaments, especially when the affections exist in scrofulous subjects. In rheumatism, and paraplegic affections also, and especially when these affections are connected with old wounds, swellings of joints, and the commencement of ossification which follows them. If there is much irritability, Néris is preferable. The water is little drunk—two or three glasses in the morning. There is another chalybeate source called that of Gonas, who discovered it in the seventeenth century, which spouts into a little basin at the south-east of the town, surmounted by a roof of zinc supported by columns. It is a chalybeate, and sometimes a few glasses are drunk before dinner for the sake of appetite. It contains muriate and carbonate of iron, and well answers the purpose for which it is used. This water is used by the country people in amaurosis. Bourbon is a dull place, and was the scene of Madame de Montespan's retreat, respecting whom M. James tells us a strange tale. "After her retirement Madame de Montespan spent the last years of her life in repentance and the practice of religious rites. On the night of her death, the rapid steps of a horse were heard, which stopped at the door of the house, a cavalier entered rudely into the chamber of death, he withdrew the clothes which covered the breast of the dying woman, tore violently away a key which she wore suspended at her neck, seized a casket enclosed in a drawer, and set off in all haste for Paris without saying a single word. * * * It was her son, the Duke of Antin. What mystery this casket concealed was never known."

### BOURBON LANCY (SAONE ET LOIRE).

These waters, too, had fallen into comparative oblivion, when the Marquis d'Aligre left a sum to build suitable establishments, and it appears that thermal buildings are to be erected on a scale unsurpassed even in Germany. The place is about as far on the east of Moulins, as Bourbon l'Archambault is on the west.

The waters were formerly famous, and it was owing to them, it is said, that Marie de Médicis was cured of her sterility before giving birth to Charles IX. If so, they did a bad service to France and mankind, for few women could do worse than bring into the world the brutal Charles,—the imbecile Francis II., husband of Mary Queen of Scots,—and the profligate, scandalous monster, Henry III. The waters do not come to the light in the town, but at St. Léger a Faubourg, situated at the foot of a mass of steep rocks which overlook the springs.

They are seven in number, that is to say, six thermal and one cold. These are disposed, one after the other, in the large court of the thermal establishment, and are received in marble basins. The most considerable and hottest is called the Lymbe, another is called the fountain of the Queen, because Marie de Médicis used it: the other sources are merely numbered. Their temperature varies from 104° to 140°. As they are near each other, and have nearly the same composition, the probability is that they have a common origin. The difference in their temperature is explicable by infiltrations of ordinary water which get through fissures into their pipes.

The overplus of the springs is poured by pipes into an open reservoir, and submitted to a previous cooling; it is then distributed to the various baths of the establishment. present number of baths, fifteen, is insufficient, and the The bathing is obliged to begin at one in the morning. The waters are limpid, and oily to the feel; they have no smell, and a mawkish taste. They are very weak in solids, containing only ·75 of a gramme to the litre: the gas which they contain is a mixture of carbonic acid and azote. Taken early in the morning, in the dose of a few glasses, they have a slight diaphoretic effect: they are employed almost entirely in baths. Popular belief on the spot would make out that they could cure almost all known diseases.

### SAINT HONORÉ (NIÈVRE).

These sulphurous waters appear to be those anciently called *Aquae Nisinei;* they come to light near Moulins en Gilbert, at the foot of the mountains of Morvan, where the cretaceous rocks join the granite. A few years ago they were lost in a meadow, but researches made by the proprietor found at the depth of five or six yards the remains of a vast thermal establishment, constructed by the Romans over the sources. Efforts have been made since 1854 to restore the ancient thermæ; the waters have been secured, and there is every probability that soon there will be an institution at St. Honoré with all the resources which modern science can develope.

The water is clear, limpid, without taste, and with a strong odour of sulphuretted hydrogen. The temperature is 86° to

90°. These sources contain less than one-tenth of their bulk of sulphuretted hydrogen, and to the English pint, of solids—

| | |
|---|---|
| Alkaline sulphuret ..................... | 0·617 grains. |
| Chloride of sodium ..................... | 2·84 ,, |

And some other salts in very feeble proportions.

A report has been published on these waters, by which it appears that several cases of chest affections, scrofula, skin diseases, have been treated at these waters. The waters are only fifteen hours by the railroad to Nevers from Paris, and as the establishment will be on a first-rate scale, and in a salubrious and picturesque locality, it seems well worthy of the traveller's while to visit this new spa.

### POUGES (NIÈVRE).

A small town seated about seven miles from Nevers, upon the great road from Paris to Lyons. There are two sources, both are cold: one is reserved to drink. It contains 33·62 grains to the English pint, of which the larger quantity are bicarbonates of lime and magnesia, with a considerable quantity of carbonic acid, and a trace of iron, and some traces of alkaline salts. It has a great reputation in the country in gravel and calculous affections; and, in point of fact, such a water seems really likely to do good. Oyster-shells calcined, and many calcareous substances, have at different times been used in these diseases. Baths also are given at Pouges in a very primitive fashion. Catarrh of the bladder is one of the diseases for which this water has a reputation.

# CHAPTER XI.

## MINERAL WATERS OF THE EAST AND OTHER PARTS OF FRANCE.

Their character.—Bourbonne.—Military Hospitals.—Properties of the Waters.—Plombières.—Roman baths.—Want of mineral principles.—Luxeuil.—Bains.—Contrexville; Waters somewhat like Vichy.—Vittel.—Other French Mineral Waters.—Campagne.

THE mineral springs of the East of France are not without some analogy to those of the centre, as well by their constitution as with regard to their medicinal virtues, but their temperature is less elevated. We do not find either any sulphurous waters of importance.

The predominating element of these waters is the chloride of sodium, which is sufficiently explained by the abundance of sea salt in the marly formations whence they proceed. If we except the small group, of which Plombières and Bains are the most important—which, in relation with the igneous formations near them, contain principally and in small quantity sulphates and alkaline carbonates—all the waters of this zone borrow evidently their dominant character from the influence of saliferous earths.

The principal sources of the east of France spring for the most part in the midst of mountains; but these are not arid, volcanic mountains like those of Auvergne; and, instead of lava and volcanic rocks, they are covered with a rich and umbrageous vegetation.

### BOURBONNE (HAUTE MARNE).

Bourbonne is a small town agreeably situated at the extremity of the Department of Haute Marne, upon the top and side of a gently-sloping hill, which is looked down upon in the distance by the chain of the Vosges. Its sources, so celebrated at present, must have been so during the time of the Romans, for nowhere have there been found more vases, medals, and votive inscriptions.

At Bourbonne are three principal sources of mineral waters.

1st. The hot fountain or La Matrelle. It springs out at once in the town, and is enclosed by a small pavilion in the form of a temple, supported by columns. It is without smell, quite limpid, its taste salt and bitter, leaves a disagreeable *arrière goût.* Temperature 136°. It is used for drink.

2nd. Le Puisard, called also the Great Source, on account of its abundance, is placed in the interior of the thermal establishment, where it furnishes baths and douches. Temperature 134°.

3rd. The Source of the Military Hospital. This source passed formerly for sulphurous, but this was owing to a circumstance well worthy of being noticed. The smell came from the remains of vegetables accumulated in the pipes and reservoirs; these having been cleared out, it has become perfectly inodorous. Although it yields 1200 hectolitres daily (about 26,400 gallons), this is hardly enough for the wants of the Military Hospital, a vast building, where, every year, 400 or 500 bathers repair. Temperature 118°.*

---

* This would seem the proper place for noticing a proposal made by Dr. Pincoffs, late civil surgeon at Scutari, in a letter to his Royal Highness the Duke of Cambridge, "On the Introduction of Mineral Water Establishments for the Use of the Army." Dr. Pincoffs points out that thermal military establishments are numerous in France, Germany, and Italy, and form an integrant part of the army medical department of those countries. He then shows, from the work of M. Herpin, that of 14,890 cases of disease common to soldiers, the percentage was: Cured, twenty-nine; relieved, forty-six; or, of cured and relieved together, seventy-five per cent. by the use of mineral waters. "A still higher percentage is shown

In physical and sensible qualities these two last waters resemble the first, but they are only used externally.

The sources of Bourbonne are identical in composition and properties. Only one is used internally, and the others externally.

The chief constituents in the pint, which contains, of solids, 66·17 grains, are—

| | |
|---|---|
| Chloride of sodium | 50·71 grains. |
| Chloride of magnesium | 3·437 ,, |
| Bromide of sodium | 0·570 ,, |

The large proportion of the last ingredient is worthy of note.

The other salts are very feeble quantities of potash, lime, iron, and magnesia.

The constitution is therefore similar to the Kochbrunnen at Wiesbaden, as far as minerals are concerned; there is no carbonic acid, but a little azote.

The front of the baths has four columns, each of a single block of marble from the quarries of the neighbourhood. The part of the baths destined to the men has thirty-two bath closets, and separate closets for the douche; that for the women has thirty-three, spacious and well-aired, also with separate douches.

---

by a computation which I made of cases treated in French military thermal hospitals, giving for 4130 cases, 1229 *perfect cures*." It may be shown that soldiers have been cured in those institutions who had resisted the treatment of ordinary hospitals. Dr. Pincoffs then proposes to his Royal Highness to establish similar hospitals for British soldiers. I made the same proposal at Scutari; and it was the subject of frequent conversation with my lamented friend, the late Dr. M'Grigor (Deputy Inspector-General). The proper place for such an institution would have been Broussa, whose hot baths are unsurpassed in the world; but the place had suffered severely from earthquakes, and shocks were even then occurring. On recovering from a severe illness (the cholera) I was proceeding on sick leave to Broussa, December 7th, 1855, when the weather rendered the proceeding impracticable. My intention was to examine the waters, and I had succeeded in procuring the apparatus of the Turkish medical school for the purpose. There remained, however, Mytilene, only a day's sail from the Dardanelles, both by climate and its waters admirably adapted for the purpose. It is to be regretted that something of the kind was not done. As Dr. Pincoffs remarks, if we have no hot sulphurous springs, we have Bath, well adapted for such a purpose.

The waters of Bourbonne are used almost entirely for baths. In moderate quantity these waters act slightly upon the skin, and as a diuretic, and are somewhat aperient.

The first symptoms in the bath are those of an agreeable heat, but soon the heart begins to beat, and the face becomes coloured, and care should be taken not to remain long enough in the bath to cause congestion of the brain. The skin, on leaving the bath, feels tightened, and has not that unctuous satiny feel which many waters give; on the contrary, it feels dry and rough. In short, from the composition, the effects should much resemble a hot sea-water bath. It is the practice after the bath to administer a douche.

The waters of Bourbonne are considered very excitant; their chief reputation is in the cure of paralysis and gun-shot wounds. In the former class of diseases, they are not found to be beneficial in organic diseases of the centres of the nervous system, the brain or spinal cord, but in paralysis characterized by atony and weakness. One may easily understand how such waters, by their alterative action, may favour the cure of old wounds: but it appears that these waters have the property of softening the osseous tissues—consequently in cases of badly-united fractures they are, perhaps, more likely to do harm than good. From observations made on soldiers arrived from Africa, it appears that these waters have a very beneficial effect in causing the absorption of abdominal tumours, the consequence of intermittent fevers, which, as is well known, are apt to leave behind them enlargements, especially of the liver and spleen, and these, after repeated attacks, become very difficult of removal. Many years ago, M. Juvet, physician to the Military Hospital, published a dissertation on the power of these waters in curing quartan which had resisted quina. Hoffmann had already recommended the salts of mineral waters in this disease. (Alibert). The waters have been found very beneficial in white swellings, &c.

Near the baths of Bourbonne there is an iron spring called la Rivière, which many of the patients use at their meals. At Bourbonne are several places where those who wish it may enjoy society, but most of the patients who go there prefer repose.

### PLOMBIÈRES (VOSGES).

Plombières is a small town situated in a deep valley in the extreme south of the Department of the Vosges. It is commanded from west to east by two high mountains, which enclose a narrow valley. The climate is temperate and healthy, but, as it is above 1300 feet above the level of the sea, the atmospheric changes are sudden and extremely severe.

There are no less than five separate thermal establishments: Bain Impérial, Bain Tempéré, Bain des Capucins, Bain Romain, and Bain des Dames.

1. Bain Impérial is a large building upon the site of an ancient Capucin convent. It contains a handsome open bath, divided into two compartments, one for the men and the other for the women, which are only separated by a kind of shutter, so that the parties can see each other, and talk from one basin to the other. All round this open bath are ranged private bath-closets with douches; there are also sudatories, the two hottest of which are called *Bains d'Enfer.* The baths communicate by means of a staircase with that part of the building which contains the theatre and casino.

2. Bain Tempéré is separated from the preceding by a street, across which there is a bridge uniting the two. On the ground floor are four handsome circular common baths, made of the marble of the Vosges, which can each contain some fifteen people; two of these are for men and two for women. At the extremity are baths for those patients who "like society without liking the same waters." As at the Bain Impérial, there are private baths and douches.

3. Bain des Capucins is a large building, but of humble appearance, separated also by a street from the Bain Tempéré, only they communicate by a tunnel instead of a bridge. The Bain des Capucins consists of a parallelogram, divided length-

wise into two compartments. The water arrives in the first by a large circular hole, celebrated like the Bubenquelle of Ems, as a remedy in sterility; the second is filled by the overplus of the first, and by a stream of very hot water which, proceeds from the floor of the bath. This bath, of a temperature higher than the others, is chiefly frequented by the poorer classes.

4. Bain Romain, a handsome building in the centre of the town, on the site of the ancient Roman baths. It is roofed with glass, and its marble pavement is heated below by the thermal water. There are twenty-four private baths with douches: these baths are both spacious and elegant. The place is a rendezvous and promenade during the cool autumn evenings.

5. Bain des Dames, is called after the ancient and famous convent of the noble ladies of Remiremont, whose property it was. On the ground floor are two common baths, with closets for douches for the poor and patients of the hospital. There is also a drinking fountain. On the first floor is a large waiting-room, surrounded by fourteen private bathrooms, provided with eighteen baths and fifteen douches. Here also the floor is heated by the water of the reservoirs.

Altogether the five establishments at Plombières can give eight hundred baths daily.

The following are the sources:—Muller-temp, 96°; Bain des Dames, 126°; Bassompierre, where there is a sudatorium, 177°; Bain Romain, the same; Capucins, a fertilizing source, 131°; Bain Impérial, 129°; Simon, 97°; Crucifix, which springs under arches, and forms a buvette, 120°; Préfecture, 83°; and the group called Savonneuses, two of which are scarcely tepid, and the other almost cold. Ten principal sources in all.

As the temperature of these waters is, in general, too great for use, they are previously submitted to a process of cooling in large cisterns. As for the common baths, all that is done is to fill them some time before the patients enter, and leave them to cool down to the requisite point. These baths have not a sufficient current to keep them constantly as pure as is desirable. All that is necessary to effect which, would be to increase the reservoirs, there being no want of water.

All the waters are oily, without odour at first, but, if the water stands twenty-four hours, it then smells.

The waters called Savonneuse, as their name imports, have a more oily or soapy feel than the others; this they owe to the presence of an aluminous substance. Some of this substance may be found in clefts of the feldspar rocks whence the water proceeds. These waters are exceedingly weak in mineral substances, containing only 4·156 grains of solids in the pint, taking the Crucifix, which is the one generally drunk. The principal salts are the bicarbonates of soda and lime, sulphate of soda, alkaline chlorides, traces of silica, alumina, iron, and arsenic, with less than one per cent. of the bulk of carbonic acid. In a chemical point of view, therefore, the composition is quite insignificant, but the properties are not the less real.

The waters are used externally and internally. Some stomachs support the waters of the Bain des Dames better than those of the Crucifix. The custom is to begin with one or two glasses daily, and gradually increase the dose to six or seven. The waters increase the appetite, and act on the skin and kidneys.

The symptoms produced by the baths are those usually experienced in baths; but if the patient rest too long, as more than an hour, the symptoms of stimulation are apt to be followed by those of depression.

The effects of the waters of Plombières have been ascribed to their mineral principles; but this view, in the opinion of the writer, cannot with truth be maintained. They, in fact, belong to that class of thermal waters, already, so far as we have proceeded, so numerous, which produce effects that cannot be accounted for by any ordinary explanation. During the first days of their use, the waters of Plombières are apt to induce want of sleep and restlessness, as well as gravelly or sandy sediments; but these symptoms are only temporary, and do not attain the dimensions of the bath-fever.

They are especially recommended in chronic affections of the stomach and intestines. In pain of the stomach, and dyspepsia after severe disease, they are found to re-excite the powers of the stomach in convalescents. When the stomach is at fault, the water itself suits best. But when the evil is in the intestines, the external application is supposed to be more suitable.

In enlargement of the liver the waters of Plombières are supposed to be more suitable than those of Vichy, which might be too exciting.

In female affections, especially where there is much nervous sensibility, the waters of Plombières have been much recommended. In the same kind of diseases where there is want of energy in the organs—in nervous affections generally—tic douloureux, St. Vitus's Dance, and paralysis of the lower part of the body caused by spinal irritation. Here shower-baths of the water are much used. Gouty and nervous rheumatism and sciatica are among the diseases for which Plombières has been much used.

It is said that the waters accelerate the development of tubercles. People having a consumptive tendency should, therefore, avoid Plombières.

Plombières is frequented by great numbers of invalids. The town possesses many sources of amusement, and the rides and walks among the mountains are very fine. It is strange that, in this most peaceful part of France, the staple manufacture of the place should consist in the manufacture of daggers and sword-sticks.*

### LUXEUIL (HAUTE SAONE),

Is situated at the foot of the Vosges, in a beautiful plain watered by the river Breuchin. The town is composed of a single street, rather dull, but showing, by its appearance, that it is inhabited by persons in easy circumstances. As has been already stated, there is yet extant an inscription proving that the thermæ of this place had been repaired by Labienus, the lieutenant of Cæsar.

---

* Plombières will be first reached from Nancy, to which there is a railroad from Paris. There is a weak chalybeate also at Plombières.

The present establishment is a handsome building, constructed upon the site of the sources, and surrounded with several ranges of trees. There are no less than seven divisions, enclosing sixty private baths, and six common baths with several douches and boxes for vapour baths. Behind the establishment is a large reservoir to collect the water, and allow it to cool to the required temperature.

The waters are limpid, inodorous, and oily to the touch; their taste leaves an *arrière goût* of astringency. They leave a blackish coat at the bottom of the basin, and silicious stalactitic concretions in the pipes.

The sources are numerous and abundant. There are eleven different springs, which vary much in temperature; that called the Grand Bain is close to 133°. They contain hardly any mineral substances according to Dr. James; nevertheless, according to an analysis before me, they contain twice as much as Plombières, having 9·760 grains in the pint, chiefly chlorides, but with some sulphates, and these the chloride of sodium, with traces of chloride of potassium, a minute quantity of alumina, iron, manganese, and arsenic. Their action is supposed to be sedative, and their chief use to calm nervous agitation. Being only ten miles from Plombières, they are not so much used as they would otherwise be. The water of the common bath is constantly renewed; men and women bathe together, pell-mell, in the same basins.

Opposite the thermal establishment is a kind of small casino. The environs of Luxeuil offer very agreeable rides or walks. The abbey, whose ruins remain, was one of the most celebrated of the middle ages. "There, after the death of Clotaire the Third, was shut up Ebroin, the terrible maire of the palace, who, at a later period, restored to liberty, exercised such cruel vengeance on his opponents."

### BAINS (VOSGES).

About the same distance from Plombières as Luxeuil, is a very small town of the Department of the Vosges, situated in a little valley surrounded on all sides by hills covered with wood. According to Vauquelin, the sources of these three thermal waters come from the same subterranean reservoir, their differences in temperature and chemical composition depending upon the stratifications through which they may pass.

The sources of Bains are no less than thirteen, whose temperature varies from 82° to 122°. The hottest and most abundant is called the Great Source. Thes esprings have been so managed that from their mixture results a medium temperature, which allows the water to be used at once.

The water is perfectly limpid and transparent, has hardly any taste, and contains only 2·642 grains in the pint—sulphates, chlorides, carbonates, and traces of arsenic. The principal ingredient is the sulphate of soda; while at Luxeuil it was the chloride of sodium, and at Plombières, the bicarbonate of soda. Neither is there any gaseous impregnation.

There are two thermal establishments, which are called the Old Bath and the New Bath (Vieux Bain, Bain Neuf). However, it happens that the Old Bath, having been recently rectified, is much the newer of the two.

1. Vieux Bain, or Roman Bath, is a handsome little building, constructed on the model of the Roman Thermæ. On the ground floor are three handsome common baths kept constantly supplied with hot water, and, on their sides, numerous dressing rooms. There are also cabinets for douches, but no private baths; these latter being on the first floor, round which is a balcony which communicates with the private baths, and overlooks the common baths.

The roof is flat, and arranged as a terrace for a walk. In the middle is a glass cupola, which gives a light and handsome air to the interior of the building.

2. Bain Neuf is a large, long building, of anything but ornamental aspect. It includes three oval common baths, arranged in a row, each one possessing a different temperature; and several cabinets for baths and douches. Men and women bathe together, as at Luxeuil. The usual waters drunk are the spring called Roman, temp. 115°; and that called Robinet de Fer, temp. 124°.

These waters are said to have a binding effect; hence the usual practice is to drink sometimes a fountain called La Vache, because the cows used to drink it before it was enclosed as at present.

M. Bailly, the inspector of the baths, is of opinion that their medicinal action has no special reference to any one organ rather than another; that they modify the *nervous sensibility* of the membrane of the stomach and intestines, mix harmoniously with the blood, and set all the organs in regular play. They also stimulate moderately the secretions; but their chief use seems to be to allay nervous irritability, as in the case quoted in the first chapter of this work. They produce no crisis, no *bad sturm*. The place itself is beautifully situated, and well adapted for quiet and repose.

### BASSANG (VOSGES),

A village amid the Vosges hills, near the highway from Nancy to Muhlhausen. Is a cold, limpid water, highly charged with carbonic acid, of which it contains, free, half its volume, and with 13·01 grains of solids to the pint, of which 0·149 is carbonate of protoxide of iron; the others salts of soda, lime, and magnesia. This water is bottled on the spot, and used in the same way as Seltzer water—drunk at dinner either alone or mixed with wine. It contains much arsenic.

### CONTREXVILLE (VOSGES),

Is situated about forty miles to the north-west of Plombières, in the arrondissement of Mirecourt, and in a little valley open at the south and north, and traversed by the little river Vair. At one time it was looked upon in the same light as Vichy is now—as a specific in gravel; but is now almost deserted, probably on account of the little pains taken to make it an agreeable residence. The climate, too, is severe and changeable.

There are three mineral springs; the one drunk is called the Pavilion. The others are called the Baths, and the Quay, and used externally. These springs are all enclosed in the bath establishment, which consists of two wings: the one on the left containing the apartments of the patients; that on the right the assembly-room. From these depart circular galleries, which end in an octagonal pavilion, closed by glass, where is brought the spring that serves for drinking. Here the patients can drink and promenade without being exposed to the weather. The baths have been re-arranged, and are in very good order, and well managed. The water has a temperature of 53°; it has a fresh, acidulous, and somewhat sharp taste. Exposed to the air, at first clear, it soon becomes covered with an iridescent pellicle. It leaves a reddish covering on the basin which receives it, similar to what the river leaves behind it. It contains 25·184 grains in the pint, of which 5·919 are bicarbonate of lime, and 1·929 bicarbonate of magnesia, 10·084 grains of sulphate of lime, and a little chloride of sodium, with some other salts, a little iron, and traces of alum, potass, strontia, phosphate of lime, and arsenic, and a slight excess of carbonic acid.

These waters must owe their property of being useful in gravel to the earthy bicarbonates, not, like Vichy, to the bicarbonate of soda. They are slightly laxative, owing, perhaps, to the small amount of magnesia they contain.

They are prescribed at first in doses of two or three glasses. The number is gradually increased until the quantity amounts to twelve or fifteen glasses, drunk in the morning fasting. Towards the close of the treatment the dose is decreased to five or six.

They quicken and increase the excretions. They are exceedingly diuretic. Calculi placed in the fountain itself will be discovered to have undergone a change after a time. The water of Contrexville may be supposed to act especially upon the mucus of the calculi, so that those expelled there have exhibited canals and irregularities on the surface. On this account they are apt to render the existence of a calculus felt, which had not been so before, by destroying the smoothness of its surface.

In gout, Contrexville has a high character, especially in that of a character common in weak habits.

These waters act upon the bowels, and, contrary to what might be supposed from the introduction of so large a quantity of water into the system, excite the appetite. In irritability of the bladder, also, these waters are found very useful.

The water, of course, has to be heated for the bath, and it is common to add three or four ounces of the bicarbonate of soda to each bath.

### VITTEL (VOSGES),

Is a water close to Contrexville, which has a considerable local reputation. It seems similar in properties to its neighbour. It is used in digestive affections—affections of the urinary organs, and green sickness.

## DIFFERENT MINERAL WATERS OF FRANCE.

Several mineral waters of France remain, which could not be included under either of the divisions of the Pyrenees, the Centre, or the East.

### BARBOTON (GERS),

A village close to Cassaubon. There are several springs scattered in the valley. They are thermal, having a temperature of from 39° to 102°. They exhale an odour of sulphuretted hydrogen. Baths of the mineral mud are used chiefly in cases of muscular contractions and chronic rheumatism.

### CASTERA VERDUZAN (GERS).

These waters were at one time in great vogue.

The thermal establishment is a large building, situated in a fertile valley on the road from Auch to Condorm. The situation is healthy. There are two sulphurous sources, and a chalybeate : the sulphurous is tepid. These waters are used in the usual cases. Great improvements are in progress at the baths, which will soon have douches and baths of all kinds.

### RENNES (AUCH).

These are thermal, saline, ferruginous springs. They have the advantage in that respect over most chalybeate springs which are cold.

### CAMPAGNE (AUCH).

Rennes and Campagne are both about half-way between Perpignan and Foix ; the former nearer Perpignan and the latter Foix. These springs were at one time in such reputation, that more than 3000 people used to repair there annually. There are three springs, viz., that of Pont, which is employed in baths and douches; temperature 81°. The source of the Buvette, which is only used for drinking; temperature 79°. In fine, the source called Jardin, which is not used. According to Balard,* the constitution in 1000 parts is 0·767 solids, of which—

| | |
|---|---|
| Sulphate of magnesia ............ | 0·156 |
| Sulphate of soda .................. | 0·066 |
| Carbonate of lime .................. | 0·340 |
| Carbonate of iron .................. | 0·008 |

Also phosphate of lime, alumina, and oxide of iron. It contains also one-tenth of its volume of carbonic acid gas.

---

* An eminent chemist, the discoverer of bromine.

The waters are therefore gaseous, chalybeate, and somewhat saline.

They are slightly laxative instead of constipating, which advantage over other chalybeates they perhaps owe to the magnesia they contain. The waters are heated artificially for baths; and M. Balard has shown that they can be so treated up to the requisite temperature without undergoing decomposition. These waters are used like other chalybeates: they are supposed to be peculiarly beneficial in female diseases, and in abdominal tumours.

### BALARUC (HERAULT),

A water of more importance than some of those just mentioned. The village is pleasantly situated upon the margin of the salt lake of Thau, which separates it from Cette, which is visible opposite, at about half an hour's distance by boat. The mineral spring arises in a kind of peninsula, and is enclosed, with its baths, douches, and sudatories, in a sufficiently unpretending building, where patients can lodge. There is only one spring, but it is very abundant: it is drawn, by means of pumps, from a series of wells, into two reservoirs, whence it is distributed to the different parts of the establishment.

The waters are limpid, of a slightly salt and sharp, not disagreeable taste. They allow carbonic acid gas to escape, and are about the most saline in France, containing 80·345 grains to the pint. These are chiefly—

| | |
|---|---|
| Chloride of sodium ...................... | 59·648 |
| Chloride of magnesium.................. | 9·418 |
| Bromides of sodium and magnesium... | 0·306 |

And some others; salts of potash, lime, iron, and magnesia in very feeble proportion: there is also a trace of arsenic. Balaruc is then a purely saline spring, by no means equal to many of our English saline springs in power; but the waters are thermal: they have a temperature of 118—119°.

They are said, in the first place, to be stimulating, when drunk to excite the appetite, and act as diuretics, dissipating mucous or other sediments. Taken in a tolerably large dose, as six or eight glasses, they are laxative.

The principal treatment is external. Balaruc has long enjoyed a great reputation for the cure of muscular paralysis and cerebral affections. The water is a good deal used in douches to the spine and nape of the neck. M. Alibert relates an interesting case of an advocate of Beziers, who had paralysis of the tongue, so that he could not pursue his vocation, and who in twenty days was cured by the waters of Balaruc. They have also a reputation in old wounds, but there are other more efficacious waters; also in chronic rheumatism, and many other affections.

It is worthy of note that the thermal waters of Balaruc do not come from volcanic rocks, but from the secondary calcareous formations.

The waters of Avène, Rieumajou, and Lamalou, are in the Department of the Herault; the latter, however, is a thermal, carbonated saline spring, not wanting in merit. The waters of Sylvanès, in the Aveyron, are thermal, ferruginous, saline.

### CRANSAC (AVEYRON),

About twenty miles from Villefranche, at the foot of a volcanic mountain, formed of schist and coal, in a state of slow combustion, as is shown by the sulphurous vapours at the top. There are two principal springs, known as Low Richard and High Richard. There are other sources of no moment.

These waters are cold, colourless, limpid, not gaseous, and of a strong styptic taste. They contain 59·990 grains in the pint (Basse Richard, Anal. Blondeau), of which the salts are chiefly sulphates of lime, magnesia, soda, alumina, iron, and manganese, and, according to the analysis before me, 0·0789 of a grain of arsenic. The water is acid, which it owes to an excess of sulphuric acid. The Basse Richard is rather aperient, and is used particularly in abdominal enlargements. The high source has a large quantity of sulphuric acid, and is rather astringent.

Bagnoles is a feeble sulphuretted water, of a temperature of 113°. It was known to the Romans; and it is difficult to say why it is not now more known and used.

### VALS (ARDÈCHE).

This is a curious water, situated in a little valley nearly surrounded by the extinct volcanoes of the Vivarais. Its solids are 62·714 grains in the pint, which are almost pure bicarbonate of soda, the portions of other salts being very minute, almost traces. It is much used by the country people in catarrh of the bladder and enlargement of the abdominal viscera, as well as in red gravel, and is useful, as its nature would imply. The sources (five) are all cold.

Nezrac (Ardèche) is a tepid water, very abundant, temperature 86°; was much frequented at the time of the Crusades. A common bath yet remains which served for the lepers. This water is moderately saline, containing 18·406 grains to the pint, chiefly alkaline and earthy carbonates; but then it is said to contain such a number of minerals as no other water under the sun has ever been fortunate enough to possess, and such rare ones, too, as molybdenum, tungsten, tantalum, titanium, zirconium, nickel, cobalt, cerium, aluminium.* The analysis must be by some *farceur*. The waters of Negrac are said to be tonic and alterative. I do not find any mention of it in a table of authenticated analyses of French waters.

### AIX (BOUCHES DU RHONE).

This place was the seat of an immense Roman thermal establishment. The principal spring is called after the proconsul Sextius, who, having derived great benefit from the waters, constructed the vast baths, whose remains may yet be admired. The waters, which have a temperature as near as possible to that of the blood, may be used of course, as they are, at their natural temperature. They are said to be soothing and sedative, but are hardly used except by the people of the country : they are almost pure spring water, except for the temperature.

---

* Dr. James, op. cit., p. 225.

### GRÉOULX (BASSES ALPS),

A small village on the southern slope of the Alps, in the middle of Provence, and traversed by the road from Marseilles to Digne, stands upon an oblong hill, which is crowned by an old castle, built by the Templars. The baths are at a few hundred paces from the village, at the bottom of a rapid descent, and in the deepest part of the valley. The spring issues in the enclosure of the baths, at a depth of ten feet : the temperature is 100°. The water has a strong smell of sulphuretted hydrogen. The water is limpid and transparent, but in mass in the bath it has a whitish colour, has a salt taste, and leaves a disagreeable *arrière goût.* It contains 43·891 grains of solids in the pint, of which 0·439 are sulphuret of calcium. (Another analysis by me gives less solids, and leaves the sulphur undetermined, giving a little carbonic acid.) The salts are soda and magnesia ; the water also contains baregine.

The water is drunk, employed in douches and baths. The baths, of white marble, are fed by a continuous stream. There is also a swimming-bath. The mineral mud is also employed in frictions or cataplasms to indolent tumours. The waters are used in rheumatic affections and in deformities of the joints. As the climate and site are equally fine, this water seems worthy of more attention than it has received. It was employed by Pauline, Princess Borghese, the sister of Napoleon, and by the Princess of Beira, the wife of Don Carlos.

Euzet (Gard) has two cold sulphurous waters, which are also bituminous ; amongst other uses they are applied as eyewashes.

### URIAGE (ISÈRE).

This is a village two leagues from Grenoble, in a pretty valley at the foot of the Alps of Dauphiné: the water springs at some depth from a rock, in the middle of alluvial formations, and is brought to the thermal establishment by a gallery more than 300 yards long, whence it is distributed by pipes to different parts.

The temperature of the source is barely 79°, so that it has to be heated for use. It is a curious circumstance that among the ruins of the old Roman bath, upon the site of which the present one is constructed, the remains of a furnace were discovered, evidently intended for the same purpose. According to M. Chevallier, this is the sole example of the kind found among the ancient thermæ. The water is quite clear as it leaves the rock, and boils by the disengagement of its gas. After a time, especially if exposed to the air, it becomes troubled, and acquires a bluish-white colour, and disengages a smell of sulphuretted hydrogen. It contains 97·596 grains of salts in the pint, chiefly chloride of sodium: it also contains alkaline and earthy sulphates, a little sulphuret of sodium, and free sulphuretted hydrogen.

It is taken internally, and used in baths. Internally it is purgative and alterative; externally it excites the skin, producing itching and prickling; but these symptoms never go on to a bath fever. It is particularly useful in skin diseases, and especially in the various forms of eczema (tetter).

Obstinate catarrhs of the mucous membranes, old ophthalmias, whites, and enlargements of the womb are also greatly benefited. The various forms of scrofula must be enumerated among the diseases benefited at Uriage.

Although the hotel connected with the establishment contains 700 beds, it is quite insufficient during the season, and many patients have to lodge in the neighbouring hamlets.

In the establishment are one hundred private baths, twelve douches, and closets for vapour-baths, douches, &c.

Near Grenoble, and situated in a fine valley of the Alps, Uriage occupies a very eligible situation. Extensive improvements are being made. It is expected that more water will be obtained, and a swimming-bath is to be added.

Allevard (Isère) is a strongly sulphurous (sulphuretted hydrogen), slightly saline, water. The waters have the usual properties of their class.

### LA MOTTE (ISÈRE).

The springs are situated eight leagues from Grenoble, in one of the most picturesque valleys of Dauphiné. They have a temperature somewhat above 143°. The spring is shut up in a narrow and almost inaccessible gorge, and is pumped up for use: during its passage it loses some of its heat. The solid contents are 71·908 grains in the pint, of which the greater portion is chloride of sodium, with sulphates of lime and magnesia, and a small quantity of iron. It is used internally, and in various ways externally. It is useful in swelling of the legs, in paralysis, and scrofulous affections. The first Emperor Napoleon thought of establishing a military hospital at the spot.

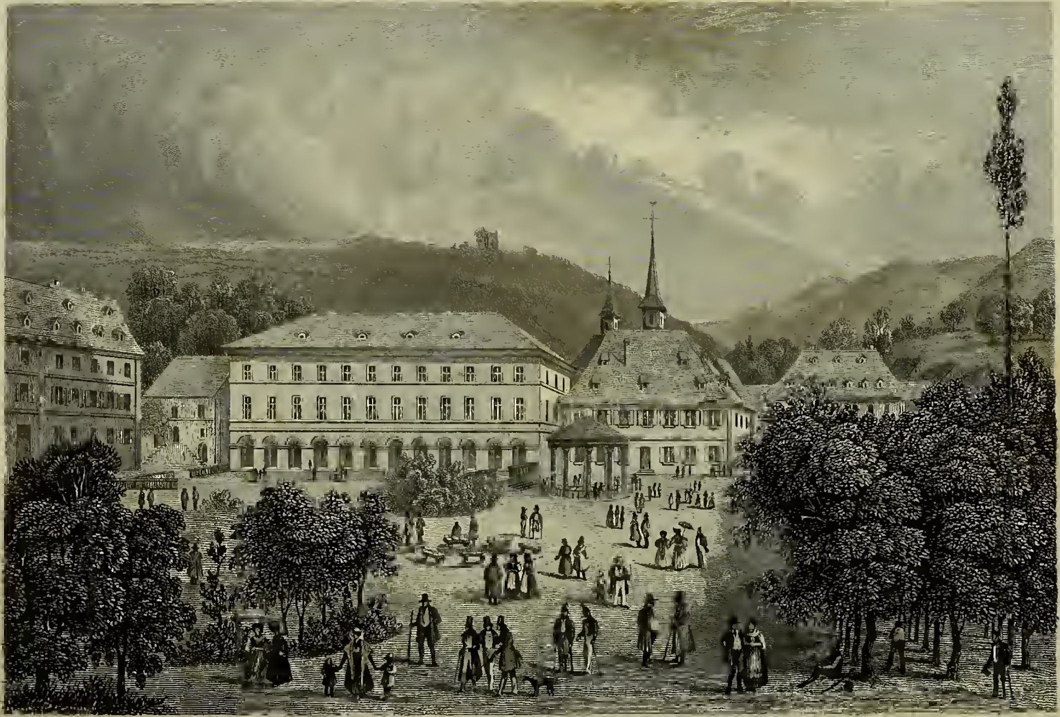
Guillon is a cold sulphurous water in the Department of the Doubs, used in baths and internally.

### SAINT GALMIER (LOIRE).

This is a cold, gaseous water, of an acid, sharpish taste. It contains more than its volume of carbonic acid gas, and 16·595 of solids, of which nearly two-thirds are bicarbonates of lime and magnesia. It is very like Seltzer water, and is used in the same way as a drink, only in affections of the stomach and urinary organs. It is in as common use at Lyons as artificial gaseous waters at Paris: the supply is abundant. *A single case of calculus has never occurred at St. Galmier.*

### SAINT ALBAN (LOIRE),

Is a gaseous water like St. Galmier, but only contains half its volume of carbonic acid gas, although it is rather stronger in salts, and contains a little iron. Its use is similar to that of Saint Galmier.



Dessiné et Gravé par C. F.

NIEDERBRONN.

N. Rémond imp.ʳ r. Vieille Estrapade, 15 Par

### CHARBONNIERE (RHONE),

At between four and five miles from Lyons, is a cold, carbonated, ferruginous water, with traces of sulphuretted hydrogen. There are baths at the place.

### NIEDERBRONN (BAS RHINE),

One of the few purgative mineral waters in France. Niederbronn is a considerable town on the eastern slope of the Vosges, rather more than twenty-five miles from Strasbourg. It is agreeably situated, and the air is dry and salubrious. There are two fountains which spring little more than twenty yards from each other, in the middle of a public walk, and are each received in a handsome basin of cut stone. These basins, of different dimensions, seem to be of Roman workmanship; the larger is sheltered by a handsome pavilion with eight columns, the other is uncovered. Both the springs are the same, and indeed their waters are mixed in the pipes.

On issuing the water is quite limpid. In the basins it assumes a dull yellow colour, whose shades vary when the weather is stormy and the air charged with electricity. Its taste is pleasantly saline, with an insipid *après goût.* The temperature of the springs is 64°. The solid contents are 41·571 grains in the pint, of which the greater part are chloride of sodium, the chlorides of calcium and magnesium, and bromide of sodium. The water contains as well chlorides of potassium, lithium, ammonium, sal ammoniac, iodide of sodium, and arsenic. The purgative properties of the water have been ascribed to the magnesia it contains, upon which Dr. James makes the following remark:—"The dose of magnesia in the water of Niederbronn hardly amounts to one-hundredth part of that of artificial Seltzer water. I have attended a patient whom a single glass of Niederbronn water would purge, while a whole bottle of Seltzer water had no effect. There is, then, something altogether peculiar in the association of the principles of a mineral water, since, if we were to calculate their activity after our artificial manipulations, we should be led into serious error. It generally requires five or six glasses of the water to produce a laxative effect. This is brought about without any irritation."

In general, chronic diseases of the abdomen, characterized by want of appetite, slowness and difficulty of digestion, tympanitis, constipation, and piles, are the affections treated at Niederbronn. These waters produce a gentle derivation towards the bowels, without disagreeable concomitants. The waters are also alterative, and improve the digestion; they have been found very useful in hypochondriac affections, in biliary calculi, and liver diseases.

Baths of the waters are administered in the various hotels with which Niederbronn is well provided. In the assembly-rooms of "Vauxhall" the stranger may encounter the beauty and fashion of this part of France. The environs are very delightful, and what will, perhaps, be but little recommendation to the Englishman, there are many forges and manufactories in the vicinity, and the glass manufactory of St. Louis, one of the finest and most important in France.

Soultzmatt is a city a few leagues from Colmar, where is found a gaseous water, much used in Alsace instead of Seltzer. Chatenois (Haut Rhine), a slightly sulphurous saline water, somewhat tepid, and Sermaize (Maine), a ferruginous saline, supposed to have been known to the Romans.

## SAINT AMAND (NORD).

Saint Amand is a village about seven miles from Valenciennes, which is very celebrated for its thermal waters, and especially for its mud. This mud is formed in the following manner :—The ground is covered with a kind of elastic soil, which is felt to bend under the feet, and which is composed of three layers of a different nature : the first and most superficial is an argillaceous turf; the second a bed of marl, and the third a fine silex united to carbonate of lime. Through this last layer an infinite number of small springs of water issue, and lixiviate the two upper layers and cause them to pass into the state of mud. A large basin covered with an elegant cupola is constructed to receive this mud, which is divided into eighty stalls, each more than a yard wide and one or two yards deep. These are filled with a semi-fluid mud, and as the weight of the body does not cause it readily to sink in the mixture, the patient is forced down by the shoulders, and then secured by a kind of rail: some are only partially immersed, others up to the chin.

The mineral water flows into these receptacles, and is constantly renewed; not so the mud, which is only replaced at the beginning of each season. Each patient, therefore, rents his own special bath. Before the bath a douche of the sulphurous water is taken. This stimulates the skin, and renders it more fit for absorption.

The bath lasts for several hours, during which time the patients endeavour to amuse themselves, and, as the stalls are close together, they play at cards, and receive visits in this strange predicament. They have a name, too, being called by the untranslatable word, "*boueux.*" These muddy gentry, on issuing from their baths, take another of a cleansing character. Proper care is taken to preserve decency.

In 100 parts the mud contains 43·56 of solids, and these solids consist of ninety per cent. of silex, and the other ten of carbonate of lime, peroxide of iron, alumina, carbonate of magnesia, and oxide of manganese. The gases are carbonic acid and sulphuretted hydrogen.

The temperature of the mud is only 62°—64°, so that at first the patient experiences a sensation of cold; but soon a strong reaction takes place, blood and heat return to the skin, and all the signs of general stimulation appear. A higher temperature is obtained in some cases by mixing in the mud of the stalls an hour before the bath sand heated in stoves; thus a temperature as high as 86° may be obtained. These baths sometimes produce an eruption of the skin. They are said to produce excellent effects in atrophy of the limbs, muscular contractions, and chronic rheumatism caught by exposure to cold; also in abdominal tumours.

### FORGES (SEINE ET MARNE),

Is eleven leagues from Rouen, traversed by the road from Paris to Dieppe, and surrounded by the Forest of Bray. Its name is taken from forges which formerly existed on its site. There are three mineral springs, which run into a sunken square construction of masonry, where each one has its separate basin. They are Cardinal, Royal, and Reinette, names derived from the residence of Cardinal Richelieu, Louis XIII., and Anne of Austria at Forges. It was said that Louis XIV. owed his existence to the good effects of the waters of Forges, but this rather taxes credulity, since the Royal visit took place five years before the birth of that prince.

Of these waters the Cardinal is the strongest and the Reinette the weakest. The Cardinal contains 0·859, or nearly a grain of the crenate and apocrenate of iron in the pint. Confervæ are found in the basins of the three sources, which, uniting with the precipitated oxide of iron, form a deposit, which being collected, has been administered internally. It seems to have no advantage over other preparations of iron. These waters are very weak in salts, but contain traces of manganese. The Cardinal contains nearly a quarter of its volume of free carbonic acid gas. As this fountain is found too strong for some, it is usual to begin with the Reinette where there is a tendency for the iron to disagree. The usual practice is to commence to drink the water early in the morning, and a glass at a time, at intervals of half an hour, taking exercise in the interim, until four or five glasses are taken.*

Without doubt the waters of Forges form an excellent chalybeate; the Cardinal is moderately charged with carbonic acid, and, as regards iron, is as strong as the Pouhon at Spa.

---

* Another instance where a chalybeate is recommended before breakfast.

### PASSY, AUTEUIL.

Like London, Paris is not without its metropolitan spas. The water of Passy is a rather strong saline, and a very strong chalybeate spring; the ferruginous principle is the sulphate of iron, and it will be found to bear out what has been said already of these strong copperas springs. Passy, as is well known, is almost a suburb of Paris, yet this water is hardly used. It contains 38·188 grains to the pint, which are almost entirely sulphates and the sulphate of lime; 4·36 are sulphate of iron, without any manganese. The waters are brought into different wells on a level with the soil. There are several of them; they have a bitter styptic taste, and leave behind them a most disagreeable taste of plaster. The presence of the large quantity of sulphate of lime is easily accounted for: the iron comes most likely from the decomposition of pyritic schists. On being exposed to the air they are covered with an iridescent pellicle, and soon let fall a deposit, which also is formed abundantly in the pipes which they pass through. As they are too disagreeable to drink in their ordinary state, the practice is to allow them to remain some time in large earthen vessels, and then, when the deposit has been permitted to form for a fortnight or three weeks, allow the water to be drunk. It has then lost its disagreeable taste and its medicinal qualities.

Auteuil is another ferruginous spring of the same character as Passy, but more saline, and better borne by the stomach.

### ENGHIEN.

This is a town about twice as far from Paris as St. Denis, accessible by rail, and close to Montmorenci, the celebrated retreat of Rousseau.

There are five springs, which are feebly saline and sulphuretted. They are used as baths, and have a sort of reputation for catarrhal affections and asthma, so that many advocates, singers, actors, and others to whom a healthy state of the organs of voice is of importance, make a practice of repairing to Enghien in the morning to drink the waters. These waters remind one of St. Bernard's Well, near Edinburgh. They are used externally (as well as internally) in baths, douches, etc.

The parties who make use of Enghien are just the class who are likely to derive benefit from a matutinal excursion to such a spa, as many Londoners might do by a morning visit to Hampstead, Kilburn, or Beulah.

Pièrrefonds is another sulphuretted spring, but at a greater distance from Paris, near the Forest of Compiègne. It is feebly saline, and feebly sulphuretted.

The same applies to Bagnoles, in Normandy, except that some of the springs have a temperature of 80°.

At Boulogne there is, or was in the time of Alibert, a chalybeate spa of respectable pretensions, much frequented by the country people. Although no stranger to Boulogne, I do not recollect the water. Some of the English residents may be acquainted with it.

# PART III.

## MINERAL WATERS OF GERMANY.

### SPAS OF GERMANY.

These may be divided into the spas near the Rhine, and those of other parts of Germany.

The sulphur waters are more rare than in France, but the gaseous and thermal waters are in great number and perfection. The hotels and kursaals are, as is well known, the finest in the world; and, although more expensive than in France, sufficiently moderate, as compared with the tariff of our English watering-places. Opinions differ about the cooking, but the traveller will certainly find enough at a German *table d'hôte* to gratify his appetite, by selecting from the abundant fare. Perhaps the order of the dishes may give him some trouble, but he is not bound to imitate the omnivorous people he will find at these places. To the monstrous appetite of the Germans, and their excessive propensity for smoking, may be attributed their tendency to liver and bowel complaints. To get rid of the *rudis indigestaque moles* with which their stomachs must be crammed, can be no easy task even for their powerful waters. Perhaps the greatest inconvenience of the German inns is in the article of beds. One writer goes so far as to deny the existence of a bed in Germany. There is a huge bolster under which the inmate swelters.

# CHAPTER XII.

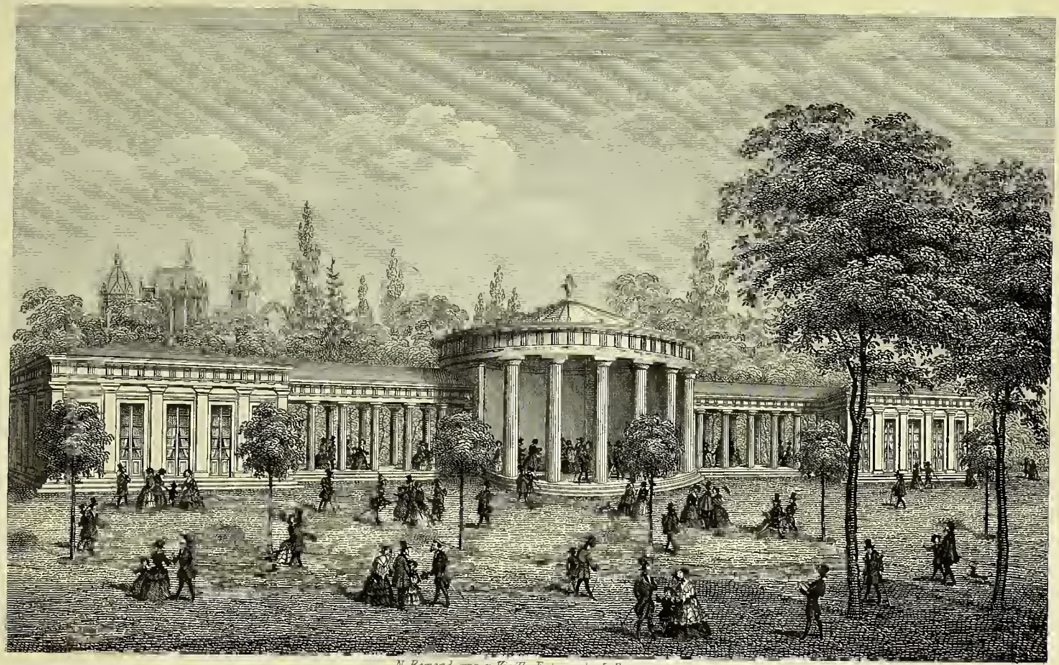
## Mineral Waters near the Rhine.

Aix-la-Chapelle, not possessed of its former fame.—Kreuznach; its great reputation; only a Brine Spring.—Ems; its reputation chiefly for Chest Affections. — Seltz. — Schwalbach; its Baths.—Sir Francis Head's description.—Schlangenbad.—The Serpent's Bath.—Power of Satinizing the Skin.—Enormous eating of the Germans.—Wiesbaden; its fine appearance; its Springs.—The Fontes Mattiaci.—The Kochbrunnen. —Symptoms produced by Baths at different Temperatures.—Effects of the Baths and Waters.—Symptoms when they disagree.—Absorption of the Waters.—Effects of the Absorption.—The *Bad-sturm.*—Resemblances and differences between the Waters of Wiesbaden and Bath.—Diseases in which the Waters are useful or injurious.—Weilbach; not a strong Water; the only Sulphur Water of any consequence in this part of Germany.—Soden; strong saline Water; its position well adapted as a Sanatorium.—Kronthal.—Hombourg; Springs saline; visited more for its social attractions.—Nauheim; its Springs saline and thermal; application of carbonic acid.—Baden-Baden; more frequented now for its Amusements than its Waters.—Wildbad; absence of any ingredient capable of accounting for the wonderful effects of the Waters.

### AIX-LA-CHAPELLE.

Imperial Aix-la-Chapelle is the first to present itself. After enjoying for long a prodigious reputation, these waters fell for a time into oblivion; but of late years their reputation has begun to revive, owing to great improvements in the buildings connected with them. Aix is situated in the midst of a valley surrounded by wooded hills. There are seven principal sources, of which six are sulphurous, and one a chalybeate, not unlike the Pouhon.

They spring in the middle of the town, and are divided into superior and inferior, according to their position. The superior are, first, the Spring of the Emperor. This, which



N Remond imp r Vieille Estrapade 16 Paris

A Hennigs Graveur und Kupferdrucker in Aachen

FONTAINE ELISE, A AIX-LA-CHAPELLE.

has a temperature of 151° has a sufficient quantity of water to aliment no less than four establishments :—The Bath of the Emperor, that of the Queen of Hungary, the New Bath, and the Fontaine Elisée, which last is the chief place for drinking the waters. It is situated exactly between the old and new towns, close to the theatre, and is one of the handsomest places of the kind in Europe. In the middle of the façade, 270 feet in length, rises the Rotunda, resembling the Temple of Vesta at Rome, being nearly fifty feet high, supported by columns flanked by two open colonnades, ending in cafés, and fronted by a promenade among trees. The fountain, from which issue two streams, is situated ten or twelve feet below the colonnade, at the end of two flights of marble steps. The source called the Büchel resembles the Emperor, and is distributed, like it, to the Bath of the Emperor and the New Bath. The source called Saint Quirin has a temperature of 120–2°. The inferior sources are situated in the street called Comphausbad; they are less hot, and contain less solid and gaseous parts than the superior sources, from which they differ very little but by their taste and smell. They are the source of the Bath of the Rose, the source Corneille, and the Old Fountain of the Drinkers (Buveurs). These sources (whose temperature varies from 111° to 117°) are distributed to as many establishments.

These sources—and we will take that of the Emperor for type, for it is the hottest, and contains most ingredients—give the smell of sulphuretted hydrogen. The water looks green in the baths, but looked at by transmitted light through a glass is colourless. Bubbles of gas escape from it; the taste is something like that of salt broth. The water, as it leaves the earth, appears to contain a good deal of sulphur, which it deposits on the ground, and which is rapidly renewed if removed. According, however, to some reasoners, the water, when it enters the bath, contains no sulphur.*

---

* It will be remembered that the possibility of something similar was hinted at in regard to Buxton and its azote.

The contents of the Emperor, according to Liebig, are nearly thirty-six grains in the pint; but the amount of sulphuretted hydrogen is so small that it hardly amounts to one-fourth of a cubic inch; or ·0834 of sulphuret of sodium; the saline matter is chiefly chloride of sodium, with, however, bromide and iodide of sodium. The waters of Aix-la-Chapelle, in doses of a few glasses, have very little *sensible* action. The principal use of the water is externally. And it is very much used in douches. After the bath, shampooing is often practised. Blood-letting, leeching, and so forth, have been thought very useful in the treatment practised at Aix-la-Chapelle.

CALOTHREA NIVALIS,
A CONFERVA FOUND IN THE WATERS OF AIX-LA-CHAPELLE.

The waters of Aix-la-Chapelle are generally believed to be possessed of remarkable activity. One reason given for this is, that they are considered to be both sulphurous and alkaline. If they have somewhat of an alkaline reaction to chemical tests, this can hardly be considered any evidence of their really alkaline qualities, medicinally speaking. They are saline waters, with slight sulphuretted power. We are told that surprising cures are annually effected, and that no sulphur water can surpass Aix-la-Chapelle. In skin diseases, in particular, the most surprising results have been obtained. Ulcers, gun-shot wounds, and scrofula, are particularly enumerated among the diseases benefited by the waters of Aix-la-Chapelle. In short, their reputation is principally as an external agent, and so accustomed are we to a kind of heterogeneous reputation of a spa, that it is almost refreshing to find one that lays claim to *one* kind of merit, which we are accordingly more inclined to admit than if it claimed, as we shall see with regard to some of the other German spas, the credit of curing almost every form of disease.

A suburb of Aix-la-Chapelle, called Borcette, possesses springs resembling those of the city itself; but there is nothing in them requiring special mention here.

### KREUZNACH (RHENISH PRUSSIA),

May be described as an assemblage of houses; salt works; and splendid hotels and kursaals, for the purposes of a spa.

This spa has a great reputation, and it may excite some surprise if we should dismiss its medicinal virtues in a somewhat summary manner; but the reader must recollect what has been said of brine springs in England, and of the Tenbury and Ashby-de-la-Zouche waters. The chief waters are those of the Elizabeth Brunnen, which are in the southern extremity of the Nahe Island, from a bore-hole penetrating into porphyry to the depth of thirty-six feet;* an enclosing basin guards against the introduction of other water. By means of a pump the water is forced into a bathing-house at some little distance, when the water is not used for drinking. A second spring rises in the bed of the river. At a depth of several feet it issues from the porphyry, and by means of an air-tight basin it is protected from the water of the Nahe; and then, by subterranean tubes, is pumped into the bathing-house where it is used: the supply is abundant. There are many fine springs in the neighbourhood, and, as is well known, this is the great seat of the manufacture of bromine from the refuse bittern, or mother matter which remains after the salt has been obtained. As so much importance is attached to the existence of bromine in the Kreuznach water to account for its properties, and for the properties of other springs containing it and iodine, it may be well to say a few words again on the subject. The three bodies (chlorine, bromine, and iodine) are generally associated throughout nature. It is a law by which we are regulated in stating the composition of a mineral water after its elements are assigned, that is to say, after we have ascertained what acids, bases, etc., it contains, and proceed to put them together in order to state our view of their existence in a water, that the strongest base is associated with the strongest acid; and thus, if in a mineral water chlorine and bromine, sodium and magnesium existed, we should give the chlorine to the sodium, and the bromine to the magnesium. These two are often associated in waters, oftener, at least, than iodine with them. Now, on evaporating a briny liquid, the chloride of sodium, being the more abundant substance, will be first precipitated, in quantity at least, although abundance of it will remain behind, while the small quantity of bromide of magnesium will remain in the residual liquid, from which its bromine can be easily extracted. This is what happens at Kreuznach; but I know abundance of brine springs in England, and especially the brine springs about Birtley, in the county of Durham, from which bromine could be obtained as readily as from the waters of Kreuznach. But here is the analysis of the Elizabeth Quelle. In sixteen ounces, specific gravity 1004·94, grains of solids—

---

* The circumstance of these brine springs coming from porphyry shows what little influence the superficial geology of a country has on the character of its waters; doubtless there are beds of salt below.

| | |
|---|---|
| Chloride of sodium ............ .. | 72·88 |
| Chloride of calcium .............. | 13·38 |
| Chloride of magnesium. ... ...... | 4·07 |
| Chloride of lithium ............... | 0·61 |
| Bromide of magnesium . ......... | 0·27 |

Or a little more than a quarter of a grain.

The other ingredients need not be particularized; they are not sufficient to give any great degree of activity, although, of course, sufficiently numerous. Traces of iodine, carbonates of lime, and baryta, etc., in minute quantity. But according to the analysis of Mialhe and Figuier, given in the early part of this work, a pint of sea-water contains nearly a grain of bromide of sodium; so that the advocates of the efficacy of the water of Kreuznach, relying upon the existence of its bromine, must admit that sea-water is likely to be more beneficial.

Dr. Sutro says—"If the taste of the water appears more bitter one day than another, this is rather to be attributed to altered gustatory function than to any change in the relative contents of the water. Though nauseous and bitter, it is borne well by the digestive organs if the doses are regulated according to the state of the bowels. Appetite improves much under the use of the water, but alvine evacuations are not promoted at first; only after gradual increase of the quantity does this result take place. Should the water be taken too quickly, or in too large quantity, the abdomen will be distended with eructations, pain of the stomach and diarrhœa will ensue." The baths are generally taken lukewarm, and with the addition of mother-lye. Ingenious modes of applying the water in douches, and so forth, have been contrived. From the continued use of the baths the skin becomes irritated after a time, and eruptions ensue. The vapours evolved in boiling the brine are found efficacious in scrofulous subjects. He then gives several cases of successful treatment, of which no doubt can be entertained.

In the course of the treatment a thermal fever declares itself, accompanied with the usual symptoms.

I entertain no doubt of the efficacy of Kreuznach water in the treatment of scrofula, especially as this treatment is conducted with care, and every means employed to direct it according to the principles of art. It is needless, therefore, to enter further into this matter; but it is not to the little quantity of bromine that the result is owing, although this may add to the efficacy of the chlorides. My object is to place this matter, of some moment, in its true light. A brine spring like Kreuznach is valuable in the treatment of diseases to those who live in an inland country, but there is nothing which it can accomplish but what the sea will do as well, or better, especially as there is the sea air as well. I could easily quote cases from my own experience, and cite from the works of others, quite sufficient to prove this.

In this case of the waters of Kreuznach no one can pretend to believe in any mysterious influence. It is all plain sailing; there is nothing but a saline mixture, such as could be prepared in any laboratory, and certainly one precisely analogous to the great mineral water of nature, to account for the facts.

### EMS (NASSAU),

Lies in a narrow valley of the Lahn, six miles from Coblentz, from which place it is easily reached. It is built on the right bank of the little river, and the slate hills rise almost perpendicularly behind it. The town is principally made up of fine hotels, with their backs against the mountain side. These hills have the advantage of protecting the town from the north winds, but the disadvantage of collecting the rays of the sun and radiating them, and as the valley is narrow, during a great part of the day the air is hot and sultry in summer. These hills, on both sides of the river, are covered with vine-trees, and generally well cultivated. The air is pure, and the climate, on the whole, very equable. The Romans appear, as usual, to have found the value of these waters, for numerous coins, medals, and other remains are found at Ems. The waters issue from the foot of the eastern mountain, a mixture of greywacke and quartz, traversed by layers of shale. There are three chief springs — the Kraenchen, the one most often drunk, the Kesselbrunn, and the Fürstenbrunn. The chief of these fountains are the two first. The Kesselbrunn has a temperature of 114–8°, the Kraenchen 83°, and the Fürstenbrunn of 91–12°. But there are also several other sources. In general the waters have a similar composition, and are decidedly alkaline. The solid contents are, in a pint, 30·69 grains in the Kesselbrunn. In the Kraenchen they are somewhat short of this quantity. 17·6 grains are bicarbonate of soda; the quantity is about the same in the Kraenchen. In the Kesselbrunn the carbonic acid gas is in the proportion of half the volume of the water, or rather more; in the Kraenchen a little more. There are also bicarbonates of magnesia in much smaller quantity. The principal salt after this is the chloride of sodium. The nature of these waters, therefore, is perfectly plain; they are highly alkaline, gaseous, saline waters; and, besides these qualities, have the advantage of being thermal. In England we unfortunately possess no example of such waters. Between the character of Ems and Vichy it would be difficult to draw a line so accurate as to enable us, from the chemical characters, to predicate the physiological and medicinal effects. Observation must do this. The waters are drunk and used externally. The usual practice is to drink them in the morning at a very early hour. The Kraenchen is generally preferred. The present practice at Ems is to take the bath in the morning, after the water has been allowed to cool during the night. It deposits on its surface a kind of cream, the result of the decomposition of some of its salts, and by the escape also of its carbonic acid, which causes others to be precipitated. The effect of these baths in producing satinization of the skin is perfectly explained by the alkalies. Besides, the other salts which the water contains exercise a stimulant effect, so that a bath of Ems water is something between an alkaline and a salt bath. At first these waters increase the appetite and secretions, and give a sensation of increase of force and vigour; then there is said to follow a kind of prostration, sadness, loss of spirits, with constipation. Often at this stage aperients may be expedient. The waters do not generally provoke crises; but when they do, these do not differ materially from the crises produced by other waters, except that they are seldom of long continuance.

These waters have a high reputation for all chest and bronchial affections; and it is at first sight a surprising thing that waters of such a different character, in different places, should have the well-established reputation of being beneficial in similar diseases. Ems, Schlangenbad, and Eaux Bonnes are examples. It is in cases of that dyspepsia which attends often a phthisical constitution before the actual phthisis has been developed, and which the late Dr. Paris well described in his work on Digestion, that Ems is especially likely to do good. When the disease has actually broken out, here as elsewhere, it is not a mineral water that can effect a cure.

Ems waters have also a great reputation on the Continent for the cure of sterility, and one of them, applied in a manner altogether physical, is called Bubenquelle from this cause.

Like Vichy, the reputation of Ems for the cure or relief of calculous affections stands high, but of late years this reputation has diminished.* So much has been said of these alkaline waters generally, and especially under the head of Vichy, and as more of them will present themselves to notice, that for the present it seems unnecessary to prolong the subject, for what holds good of one alkaline water of the decided character of Ems applies nearly as well to another.†

In a watering-place like Ems, appropriated in great part at present to phthisical cases, it is of great importance to the patient to have suitable accommodation.

---

* This is owing probably to no want of power in the waters of Ems, but to the fact of fashion having changed in favour of Vichy.

† The effect of soda in dissolving albumen, however, may be referred to. In this way these waters may act in a twofold manner :—1st, by fluidifying the blood; and 2nd, by dissolving the tuberculous matter in the lungs of consumptive patients, which is chiefly composed of albumen. The blood rendered more fluid, may also more easily circulate through the lungs. Besides, soda is a depressing agent, and may act as a calmative. The experiments of Mr. Blake on some of these points, published some years ago, were very important.

The first of the establishments, the Kursaal, has the waters in it, and patients can be well accommodated. At the other end of the village is the Four Towers, where also baths are to be got, and patients lodged, but the waters are brought to it in pipes, and some fear that a portion of the medicinal virtues may be lost. Opposite the Kursaal, on the other side of the Lahn, a new building is in course of construction. Here a new spring has been discovered, having a temperature of 116·6°, that is to say, one of the highest presented by the waters of Ems. It is also very abundant and strong in mineral principles. The Kursaal has gardens attached to it. Numerous excursions can be made. Near Ems is the gothic castle of Stolzenfels and the fortress of Ehrenbreitstein. Excursions can be made as far as the banks of the Rhine,

> "Whose breast of waters proudly swells
> Beneath the banks that bear the vine."

For the purpose of excursions, asses picturesquely equipped are provided. In the evening réunions are held in the Kursaal, from which all sharpers are excluded; so that the vice of gambling is unkown. Among other circumstances connected with Ems may be mentioned the fact that its reputation has been much increased from the circumstance of the Empress of Russia having received much benefit, if not a temporary cure, for her well-known pulmonary complaint, by drinking the waters and residing at Ems.

## SELTERS OR SELTZ (NASSAU).

Who has not heard of Seltzer water?

> "Ring for your valet, bid him hither bring
> Some hock and *Seltzer* water."

One may almost wonder how the cunning Archimage, who has fabricated in the bowels of the earth so many productions, useful no doubt, but anything else than pleasant, ever came to hit upon this most agreeable of all nature's mineral productions, so much so that art toils after, attempting in vain to surpass it. The fortunate Duke of Nassau might have owned a gold mine less profitable; and there is many a manufactory whose inmates would gladly exchange their equally monotonous, but less healthy, occupation for the task of the villagers employed in bottling Seltzer water.

Seltz is eleven leagues from Frankfort and ten from Mayence, in a pleasant valley watered by the Emsbach. The water spouts out with great force and noise; although its basin is twelve feet deep, the water is so clear that the bubbles can be seen to leave the earth, and, rising like so many pearls, spring to the surface, where they simulate a real ebullition. The temperature of the water is about 60°, so that it is above the average. It contains considerably more than its volume of carbonic acid gas. With regard to the effervescence of these carbonated waters, it may be here remarked, that although *distilled* water would retain the quantity of carbonic acid gas in Seltzer water, it is very different with a water strongly impregnated with salts.*

It contains in the pint 32·085 grains of solids, of which

| | | |
|---|---|---|
| Chloride of sodium | 18·5 | grains. |
| Carbonate of soda | 9·032 | ,, |
| Sulphate of soda | 0·900 | ,, |

Besides salts of lime and magnesia and traces of iron.

The artificial Seltzer waters contain more gas than the natural, but it may be questioned how far this is an advantage. The natural Seltzer water stimulates gently the stomach, and allows its salts to penetrate the system; while the artificial, by its large amount of gas, distends the stomach. The natural water retains its gas for a much longer period than the artificial. To enlarge upon the properties of Seltzer water would be absurd; besides being a grateful beverage, it is an antacid, alterative and slightly aperient.

---

* It is a practice in chemistry to collect gases—which cannot be collected over water on account of their affinity for it, or over mercury, because they would act on it—in strong saline solutions, that the presence of the salt in the water may render it unable to retain the gas.

One word may not be amiss here about the use and abuse of effervescing drinks. It may be seen that these things are not inert. There can be no doubt but that the too great use of them may over-stimulate the stomach on the one hand, by too frequent doses of carbonic acid; and that on the other hand, the absorption of soda into the blood may render this more fluid, and perhaps be more injurious than is supposed. It will be remembered that Mr. West, in speaking of Holbeck water—a highly sodaic water, in common use at Leeds, at the British Association meeting, propounded a query with regard to the use of these waters habitually taken as common drinks.

### SCHWALBACH (NASSAU),

Situated on the road from Ems to Wiesbaden, in a narrow valley, almost lost in the forest, in wild but also cultivated scenery. The town is a long street, bordered by plain houses. The hotels form a kind of semicircle, in the middle of which is the Kursaal, which is a plain building. At Schwalbach there are not the distractions of some of the spas, but the recreations are mostly of a rural and quiet character. The persons who repair to these waters in general go to recruit exhausted constitutions. A great proportion of the patients consists of young females, whose strength does not admit of the changes required at the time of life, or women exhausted by severe labour or uterine discharges; or young men who have led, as the phrase is, a gay life; men exhausted by the fatiguing life of towns or excess of labour, and thus in a state of premature old age.

The waters are chalybeate and gaseous; carbonate of iron held in solution by a great excess of carbonic acid. There are four principal springs, with a temperature of about 50°. They are the Weinbrunn, situated near the Kursaal, along the Wiesbaden road, in a delightful valley. It is the most powerful of the springs, containing three-fourths of a grain of carbonate of iron in the pint, with about 12·5 grains of solids, almost all bicarbonates of soda, magnesia, and lime, with forty-nine per cent. of carbonic acid. The taste is sharp and acidulous, so as somewhat to cover that of the iron. The Pauline-brunn, further off than the Weinbrunn, has only half a grain of iron with six grains of carbonate of soda, two of carbonate of lime, three of magnesia, and 50 cubic inches of carbonic acid gas. The source of the Rosenbrunn is close to this spring, is heavier, containing less gas, and is therefore used in baths. The Stahl-brunn has three-fourths of a grain of iron, and only eight grains of solids. The analyses of it differ as to the amount of carbonic acid. According to one analysis before me, it contains rather more than its own bulk. The baths are all heated to 86°.

There are other waters in Germany which contain more iron than those of Schwalbach, but in none does the iron offer more resistance to the decomposing power of the air.

It is this fixity, causing the iron to be retained, that especially fits these waters for baths, and causes them to enter the system in drink. With regard to the use of these waters, the practice is to drink them fasting to the extent of one to three glasses, a quarter of an hour being interposed between each glass before breakfast during the spring and summer. The character of the diseases in which they are beneficial has been sufficiently indicated; in such there are about the best iron waters known. The usual precautions in the use of iron waters should be carefully attended to.

As to the external use of Schwalbach springs, the waters are conducted into a superb thermal establishment, and used in baths and douches. The baths are heated by the method of Schwarz. This consists in using baths constructed with a double bottom, the upper of copper and the lower of wood; into this a stopcock is fitted, with a tube connected with a reservoir of boiling water, the vapour is let in from this, and in ten minutes the water can be raised to the temperature required.

Sir Francis Head's description of these baths is inimitable:—"As soon as the patient was ready to enter his bath, the first thing which crossed his mind as he stood shivering on the brink, was a disinclination to dip his foot into a mixture which looked about as thick as a horse-pond, and about the colour of mulligatawny soup. However, having come as far as Langen Schwalbach, there was nothing to say but *en avant*, and so, descending the steps, he got into stuff so deeply coloured with the red oxide of iron that the body, when a couple of inches below the surface, was invisible. The temperature of the water was neither hot nor cold, but he was no sooner immersed in it than he felt it was evidently of a strengthening, bracing nature, and he could have almost fancied himself lying with a set of hides in a tan-pit. These baths are said to be very apt to produce head-ache, sleepiness, and other slightly apoplectic symptoms; but surely this arises from the silly habit of not immersing the head." Here he is in error; the effect of the baths arises doubtless from some absorption of the iron. The same writer gives a most graphic description of the effects of the Pauline in producing a tendency to exercise and sharpening the appetite.

The alley of the Saale, with its shady trees, is an excellent spot for exercise. It is common to come from a great distance to make pic-nic excursions to Schwalbach and its environs. In conclusion, among the many diseases in which Schwalbach is beneficial must be mentioned especially sterility.

## SCHLANGENBAD (NASSAU),

Is only a league from Schwalbach. The road to it is through a wooded country, and the place is situated in a deep valley surrounded by mountains. It is only two hours from Wiesbaden, by a road which winds by hill and dale.

There are eight sources of the mineral waters, which, as is often the practice at English spas, are distinguished numerically. They are grouped four in each of two buildings near each other, and called, by reason of their difference of level, superior and inferior. The water is clear, transparent, and perfectly limpid. In bulk it has a slightly bluish tint; the temperature varies from 80° to 90°. There is neither, taste nor smell; the composition is perfectly insignificant, there being only a grain or two of carbonate and muriate of soda to the pint.

One of the most remarkable effects of Schlangenbad is the satinization of the skin spoken of by all writers. Dr. Johnson seems to think this effect greater than at Wildbad, Wiesbaden, or Baden-Baden; less so than at Ems. Bathing in common is not the practice at Schlangenbad. The baths are very convenient; each private bath has a dressing-room, and a large and spacious marble bath capable of containing five or six people, though only used for one, and about two feet deep, so as to admit of free motion. The satiny feel it is difficult to account for. In the vicinity it is ascribed to the little serpents, innocent enough (*colubra flavescens*), with which the valleys and woods near the place abound. If it were owing to a bituminous principle, there would be some traces in the bath. Sir F. Head doubts the permanency of this satinization, and Dr. Johnson adds that there is little doubt that if half a pound of carbonate of soda or potash were added to a common warm bath in England the same softness of skin would be produced. But this is not a sufficient explanation, for there is no carbonate of soda worth mentioning in Schlangenbad: the fact must remain one of those things so difficult of explanation in connexion with mineral waters. The waters, besides softening the skin, whiten it; hence it may be supposed that these baths are favourites with ladies.

They have a wonderfully soothing effect on the nervous system, and are prescribed with great success in those affections which our forefathers used to call the vapours. In irritable skin affections, in all cases of too great excitement of the circulation, in headaches and sleeplessness, where congestion of the head has been produced by Schwalbach, they are used. Their internal use is not much trusted to.

Phthisical patients may with advantage resort to Schlangenbad during the very fine season; and goats are kept on the hills for the milk. The air is remarkably pure and bracing, but at particular times cold. The elevation is a little more than 900 feet, but the place is well sheltered.

Dr. Johnson comments upon the enormous eating which he was a witness to at the *table d'hôte* here. For the first course soup, boiled beef, pickles, and saur krout, raw ham, partridge, ducks, etc.; then came fish, then puddings, then toasts, then preserves, cakes, and custards; then dessert. He remarks on the effect of this on the complexions, and, with the inveterate smoking, on the teeth of the Germans, upon their tendency to hæmorrhoids, of which their medical men make so much, and compares the rate of mortality of London with the nearly double mortality of Vienna.*

## WIESBADEN (NASSAU),

Situated four miles from Biberich, with the ridge of the Taunus to the north-east, and the country open between it and the south-west. It is now accessible by railway; it is the capital of the Duchy of Nassau, and contains a population of eight or nine thousand. The place is healthy, although rather warm; the hills which surround it are richly cultivated, and the appearance of the town, with its brilliant white houses, is in the greatest degree delightful. The outer streets are regular and broad; a double row of trees surrounds the city, and forms splendid walks and rides, but on entering the interior much of this fine aspect ceases, since the streets are narrow and unclean. Of course the strangers and invalids dwell in the exterior portions.

The springs are supposed to be the Fontes Mattiaci, mentioned by Pliny. There are eighteen of them, which arise in the old part of the town, on the southern slope of the Taunus, all thermal. Only one is of much importance; it is the hottest and richest in saline matters, and is the one invariably used by strangers—the celebrated Kochbrunn, or boiling spring.

---

* Dr. Johnson remarks very properly, that the peasantry would not send their cattle to Schlangenbad to bathe at some expense, if they did not believe in the virtues of the water.

The Kochbrunn, although the temperature reaches 160°, does not boil from heat, but has the appearance of boiling from the evolution of numerous bubbles of gas disengaged. It springs in a basin in an open pavilion, whence by pipes it is carried to different parts of the town, to the hotels, and various places which use it; a cloud of vapour, visible at a great distance, covers the source. The water is in itself limpid, but a kind of cream forms at the top; the taste is like that of bad salt broth. A deposit forms on the bottom of the basin of an ochrey character. There are two analyses of this spring before me, one by Walchner, and the other by Fresenius, differing slightly, and Dr. Johnson gives different results altogether. According to Walchner, the contents are 71·31 grains of salts in the pint, of which no less than 64·33 are chloride of sodium, the remainder salts of potash, lime, iron and magnesia in very feeble proportion; there are also iodide of magnesium, carbonate of manganese, arseniate of lime, chloride of potassium, chloride of ammonium (*sal ammoniac*), bromide of magnesium; and it was in this water that arsenic was first discovered as arseniate of lime. The carbonic acid gas is one-fifth of the bulk of the water. The boiling as the water escapes is caused by the disengagement of atmospheric air rather than of carbonic acid.

The water of the Kochbrunn is more used as a bath than taken internally; it is, however, drunk. It requires to be cooled either way. Taken in a dose of three or four glasses early in the morning, it is generally laxative, sometimes the reverse. There often results a great improvement of the appetite. The first dose should be taken before breakfast, the second in the evening before a late dinner, or in the forenoon before, or in the afternoon after, an early one. If the baths are taken at 86° or 90°, there is slight chilliness at first; they are calmative, and the excretory functions are increased. At 94° or 98° there is a great excitement of the vital powers. The weight has been found increased from half a pound to a pound and a half; above 98° the symptoms are those of excessive excitement.

When the waters disagree they produce furred tongue, prostration of strength, loss of appetite, constipation of the bowels, irritability, perspiration, palpitations of the heart, eruptions, &c., which symptoms should cause the internal and external use of the baths to be suspended. Besides these symptoms—which may occur soon after the use of the waters is commenced, and are simply signs that they disagree—there is another series, caused by the regular passage of the water into the system; this may arise from the use of the baths as well as from the ingestion of the waters, since it has been proved experimentally, as has been said, that absorption takes place from the increase of weight. When, then, this second series of symptoms takes place, it is seldom before the end of a fortnight that any effect is produced: the symptoms are excessive tendency to perspiration, frequently a minute eruption; sometimes there are considerable discharges from the bowels, or the kidneys are excited, and sediments are excreted. These are all the symptoms of the *badsturm*, and announce a crisis with the expulsion of morbific matter; and they subside as the morbific principle is expelled.

The cases in which these waters are likely to be beneficial may be conceived from their composition. First comes gout, for the cure of which Wiesbaden has a great reputation, and especially the chronic forms. What has been said of Bath applies to Wiesbaden; for these two waters closely resemble each other, except that Wiesbaden has common salt for its chief ingredient, while, in the case of Bath, the principal chemical element is the sulphate of lime, which is not unlikely, as before said, to have some particular action. In almost all cases of gout the patient is likely to experience an aggravation of the symptoms before a cure takes place. The forms of gout in which these waters are most likely to be beneficial are those of the chronic kind. The same precisely applies to rheumatism.

Where the rheumatism passes from joint to joint, and causes gradual tumefaction with dull pain—in short, in that form which bears considerable resemblance to chronic gout—benefit is almost certain. These waters are said to have the power of restraining piles when in excess, and encouraging them when languid. In almost all cases connected with the use of German waters, this idea of the importance of these hæmorrhoids will be found to exist. Hypochondriasis is one of those diseases in which, according to German notions, the suppression of these troublesome formations may be the cause of the complaint. A German at a watering-place is as anxious for their appearance as other people are to get rid of them. How far the idea may be exaggerated, it is not easy to say.

In chronic enlargements of the abdominal organs the aperient waters of Pullna or Kissingen are safer. And where there is tendency to apoplexy the waters of Wiesbaden are positively dangerous, and have proved fatal. In plethora of the abdominal organs with vitiated bile, a state of things to which the inhabitants of large cities (*e. g.* the Londoners) are subject; in general debility; in paralysis, not arising from apoplexy; in old wounds—all the class of cases for which Bath has been recommended—Wiesbaden is celebrated. Dr. Granville draws a miserable picture of the sufferings of hypochondriacs at this watering-place, and their mutual complaints. Nevertheless, few places afford greater means of dissipating *ennui.* The Kursaal is a brilliant place of assemblage, unfortunately tarnished with gambling. Living is not expensive, and there is an agreeable country around. The number of visitors at Wiesbaden numbers some fifteen hundred to two thousand annually.

### WEILBACH (NASSAU),

Is easily reached by rail in various directions. In going from Frankfort to Mayence—on the right is the station of Florsheim—near which, surrounded by trees, is a solitary building, which is the thermal establishment of Wielbach.

The water, which is sulphurous, escapes into a marble basin in a pavilion near the establishment, to which it is conveyed in pipes ; it has very little sulphurous flavour, and probably would not be so much used but for the extreme rarity of sulphurous waters on the Rhine. The temperature is 57°, and, of course, the water has to be heated for use. The water is *said* to contain three cubic inches to the German pound of sixteen ounces, of sulphuretted hydrogen gas. In this case it should be a pretty strong sulphuretted water as regards gas. It, moreover, contains more than a fifth of its bulk of carbonic acid gas, some azote, some ordinary salts, a little strontia, and hardly anything else. Except for the carbonic acid, the spa would resemble our own Gilsland or Moffat ; and as the neighbourhood produces few attractions, an English invalid is not likely to go abroad to visit Weilbach. It may be well—by way of contrasting it with Moffat or Gilsland, or some of our own sulphur waters—to see for what diseases it is recommended in Germany. It is used principally there in chest diseases, where its action is supposed to be sedative, and in hæmorrhagic affections and in hæmorrhoidal tumours.

## SODEN (NASSAU).

Weilbach, Soden, Kronthal, and Hombourg all lie within very easy distances of Frankfort, to the west and north, and are placed in a row—like the stars of Orion's belt—all easily accessible by rail and omnibus. Soden is three leagues from Frankfort, and six from Wiesbaden. Soden is a watering-place of the village order, situated in a charming country, possessing a handsome kursaal, and elegant accommodation for residents. Its waters are saline and gaseous. The water is one of the most saline in Germany, containing 137·6 grains in the pint, of which nearly all are chloride of sodium—taking the most saline of the springs, which is No. 6A, and it contains nearly half its volume of carbonic acid gas. There are twenty-three springs arising from the schistic rocks. These sources are scattered through the village. They are all saline, and contain much carbonic acid. They have a temperature above the average, without being hot: for instance, No. 1 has a temperature of 75°; No. 6A has a temperature of 64°. The waters are used in chest affections and in dyspepsia. Some, containing much less salts than No. 6A, do not purge; they act in that case as mild tonics. No. 6A, and some others, are used chiefly as alterative aperients and tonics in abdominal obstructions; the waters are also used in atonic gout, in scrofulous affections, and diseases of the female sex. The waters have a great reputation in Germany in chest diseases. The situation of the village, leaning on a mountain, and protected from the north by the Taunus, is admirably adapted, like our own Malvern, for such a purpose as that of a sanatorium.

### KRONTHAL.

It is another advantage of Soden, that near it are several ferruginous springs, along the slope of the Taunus. At Kronthal, in particular, are two iron springs well charged with carbonic acid. The visitor, therefore, at Soden, after purifying the system by means of the saline springs, could fortify it, in the course of his rides and walks in the neighbourhood, by the use of chalybeates.

### HOMBOURG (HESSE).

This spa, which has a great reputation, is easily reached by omnibus from Frankfort, from which it is distant three leagues, and is connected by a good road. The place is built upon a hill at the eastern extremity of the Taunus. The kursaal, in the centre of the little place, is a magnificent edifice. Close to it is the park, with charming groves, and in it are the springs. Hombourg is the residence of the Landgrave of Hesse. There are four springs, all cold, and all muriated. The principal, the one called Elizabeth, although not the strongest, is the one most frequented. The source called the Emperor should contain 172·4 grains of solids to the pint; almost all chloride of sodium. This is the most purgative of all the waters. The other springs are one called the St. Louis, which is very like the spring Elizabeth, strongly charged with carbonic acid; the Ferruginous Spring containing 119·310 grains to the pint, of which 90·73 are common salt, and 1·0489 iron, held in solution by less than one-tenth of the bulk of the water of carbonic acid. The springs arise near each other, mostly the produce of Artesian wells, and are received into basins near each other. There are baths and douches in the kursaal. It is common to add to the water, in order to increase its purgative effect, a dose of mother-water from the salt springs of Nauheim. It is plain that the chief use of these waters must be internal. The diseases treated at Hombourg are mostly abdominal affections, from ordinary dyspepsia to organic lesions, diseases characterized by irregularities of appetite, pain in the side, irregular bowels, often constipation, and, in fact, hypochondriac symptoms. It is evident that the waters cannot be of much moment as baths, since they are not thermal. In female complaints, generally, they are likely to be found beneficial; and, like all the muriated waters, they will stimulate the glandular system. It will be seen that many of the waters on the Continent do not differ materially from waters which we have in abundance in England, except by the presence of carbonic acid gas, or by their thermal character.

The waters of Hombourg are not now so much in vogue The place is a good deal frequented for its amusements, its gambling and so forth, and the surrounding country also is very beautiful.

## NAUHEIM (ELECTORAL HESSE),

May be reached by railway from Frankfort or Cassel. The springs of Nauheim are so rich in salts that it is supposed their possession was the cause of strife among the German tribes in ancient times. The place is, in fact, possessed of saline springs of considerable value; but they are not much known. One reason may be that Nauheim is a manufacturing town, and not possessed of the same attractions as those of some other places. There are five sources of consequence :—The Kurbrunn, Salzbrunn, and the Greater Sprudel. There is also the Kleiner Sprudel and the Alkalischer Sauerling. The Greater Sprudel contains 290·64 grains in the pint, according to one analysis, nearly all chloride of sodium, and 46 per cent. of carbonic acid. It has a temperature of 88·7°. A quantity of atmospheric air emerges with it, so that the water boils up like a pyramid. It was only obtained in 1846 by sinking an Artesian well. For a long time nothing was obtained, but at last a subterranean explosion was heard, and the water boiled up. This water is used for the baths at its natural temperature. It is also used internally, and is very purgative. The Kleiner Sprudel has the same temperature, and also serves for baths and douches. The Kurbrunn contains much carbonic acid, and is used as well as the Kleiner Sprudel, which has about its own bulk of gas, for the local application of carbonic acid. Nothing can be simpler than the mode of application. The party is put into a box, with the head exposed, and the gas is directed into the box. The effects have been already described. The waters, which are very similar to those of Kreuznach, contain much less bromide of sodium.

It is plain that these waters are capable of more extensive use than they have yet been applied to. A kursaal has been erected, and they will probably come more into vogue.

### BADEN-BADEN (BADEN).

It is needless to mention the facility of access to this watering-place, more renowned than all the spas of Germany, or perhaps of the world; less, perhaps, on account of the renown of its waters in the present day, than as a fashionable place of resort. The city was the ancient Aurelia of the Romans; and the remains of their magnificent thermal establishments have been found, of which some idea may be formed from the engraving of the one at Bath. " The thermal springs here," says Dr. Johnson, "are of great antiquity. They served to scour the Roman legions stationed at Baden in the days of Aurelian, as they now do to scour the pigs and poultry, the butchers and poulterers, of the same place. The far-famed Ursprung issues from the ruins of an old Roman structure on the side of a hill overlooking the town, at a temperature of 154°, and in quantities sufficient to wash and drench the whole town, visitors and all."* Although there are twelve springs at Baden-Baden, yet the Ursprung is the only one which requires particular notice. The work spoken of is a circular tower on a hill commanding the town, whence a cloud of vapour rises. The spring issues, like a rivulet, across a marble pavement into a reservoir, whence it is conducted in pipes to the other side of the valley, where it is used. The Trinkale is a handsome edifice in the park, where the water is drunk. There is a colonnade for exercise, with handsome paintings in the covered gallery. The water is limpid, and has less saline or brothy taste than the Kochbrunnen. There is, however, a kind of animal odour. The whole ingredients in a pint do not exceed 26·33 grains, of which chloride of sodium constitutes 18·8, the other ingredients being chiefly chloride of magnesium and sulphate of lime.

This is another instance where a water owes its power to its thermality. Nevertheless the drinkers think, at least, that they derive more benefit from its ingestion, independent of its other effects, than from those of simple warm water. In general the drinkers add something else to the waters. Some take goat's milk; others, finding the water astringent, add some aperient salts. Others, again, take other mineral waters than those of the place, as Vichy, or Spa, or Karlsbad, so that it becomes somewhat difficult to ascribe the share of benefit, especially in the case of those who bathe in Baden waters. Of the danger of hot-bathing, in some cases, an instance is related by Dr. Granville, who, speaking of Baden, says :—"A rich merchant, who, a few hours before, had been noticed on the public promenade after dinner, on the day of our arrival, was found dead in a bath at eight o'clock of the same evening. A lady was pointed out to me who had lost the use of her limbs after using three hot-baths. If people stay in a hot-bath from half an hour to an hour, they, being invalids, at least should not do so without competent advice."

---

* "Pilgrimage to the Spas."

The water is brought to the various hotels by pipes. To repeat what has been said with regard to similar baths again in regard to Baden-Baden, would be superfluous. Perhaps the water has less the reputation than any other water of acting by a mysterious power, or any principle hidden yet from chemical analysis. Its alleged virtues are reduced nearly in all estimation to those of simple hot water. This is a fact of some importance, since where we find very different notions credited, it gives the more strength to these views of the occasional presence of some hitherto hidden influence.

### WILDBAD (WURTEMBURG).

This watering-place, to which so much interest is attached, is in the kingdom of Wurtemburg, not many leagues from Stuttgard. It can be reached from the railway station at Durlach, near Carlsruhe, and thence by omnibus; or from Baden-Baden through some of the mountainous and picturesque scenery of the Black Forest. It is distant about thirty miles from Baden-Baden. Wildbad is situated at the bottom of one of the most romantic valleys of the Black Forest. The place itself is some 1400 feet above the sea, and the mountains which shut it in rise to the height of 1500 feet above the valley. An hour at least of the rising and setting sun is unseen or unfelt at Wildbad, except in the curious phenomenon of the sunshine creeping down the western mountains "in the morning, and up the eastern mountains in the evening."

The valley lies nearly north and south, and consequently the winds are felt only in these directions.* The temperature of the atmosphere varies considerably, but cold prevails on the whole. Snow often lies on the mountains from the middle of November till the middle of May. From the beginning of July till the middle of August the heat is very great. According to Professor Heim, quoted by Dr. Johnson, in the season months of June, July, August, and September, the temperature is almost insupportable about mid-day, when the breeze is hardly perceptible in the depth of the valley. In these months, in 1834, there were forty-seven clear days, five thunder-storms, and thirty-four rainy days. The thermometer sometimes reaches 90°. The town is composed of a single street, divided into an upper and lower town ; the houses are some of them those of very poor people, and on the other hand some are well built and provided with every comfort : there are good hotels. The warm springs, of which there are about fifty, issue from crevices in the granite rock, isolated from each other ; they are received in a thermal establishment, where patients can lodge. The sources are all the produce of digging or sinking to a short depth ; almost any excavation of twenty-five yards enables water to be easily procured ; and the kursaal is thus built upon the sources themselves. Every common bath has several, and every private bath has its own spring. In these baths the patients lie upon a fine sand, which covers the source whence the water issues bubbling up. This gives a most agreeable sensation to the bather, as he feels the bubbles bursting by him.

There are six common baths, three for women and three for men, and one for both sexes, but they bathe there alternately. This last bath, called that of the Princess Furstenbad, is very elegant. There are douches attached to these in particular compartments, and dressing-rooms. Before entering the bath, each bather takes a bath of cleanliness. Drinking the water is not looked on as an important element in the treatment. The water is perfectly transparent and limpid, without smell or taste; its temperature varies from 86° to 98·6°; it is, therefore, admirably adapted for baths. Although the analysis of this water reveals so little, yet, on account of the effects ascribed to it, it may be well to give its composition.

---

* This is very common of course in mountainous countries.

The water, then, contains about four grains to the pint of solids, which consist of chloride of sodium, carbonate of lime, and carbonate of soda. As for the gas which comes up, and of which much has been made, Dr. Sutro means, I presume, that it contains eighty per cent. of azote, which is inconsistent with the most recent statement I have seen,* that it is chiefly common air, with some excess of carbonic acid. The quantity of this gas seems to vary materially from time to time, as appears to be the case with Buxton; for Dr. Johnson, in criticising Dr. Granville's enthusiastic description of Wildbad, says,—and the passage is so like what one might expect from this accomplished physician, who all his life was opposed to anything like what we ordinarily designate as flummery—"I dispensed with the attendance of the badmeister, locked the door, descended into the bath, and, creeping to the identical spot where Dr. Granville experienced the ecstatic state of a devotee blended with the repose of an opium-eater, I waited, not without some impatience, the advent of this foretaste of Paradise; but no such good fortune awaited me. I eyed the gas bubbles that rose around me, not indeed in millions, nor even in dozens, but so sparingly that I could easily have counted them, 'eager though they had been to quiver through the lucid water' in their ascent to greet my friend and confrère a few years previously."† He thinks there is no great difference between Wildbad and other thermal waters.

On the other hand, we are told that, after the first impression of the bath, which is delicious, sensations succeed of a bolder, clearer character, great excitement, luminous scintillations, the temples pulsate, it seems as if a more subtle blood flowed towards the brain; one would like to rest in the bath, but something unusual and strange advertises you to get out.

---

* Dr. James.

† "Pilgrimage to the Spas," p. 107.

Among other properties ascribed to these waters is one which many will highly prize—the power of making the old young.

The principal patients at Wildbad are as Dr. Johnson describes them:—"The maimed, the lame, the paralytic, and the rheumatic constituted nine-tenths of the assemblage;" and, as it is well put by another writer, and in accordance with the experience of all the writers on the subject, "Cast a glance on the persons who frequent these waters, they are almost all paraplegic; interrogate them, the greater part are better, or on the way to cure." The rule of administration at Wildbad is to employ baths of a few minutes, then to extend the term gradually, so as to arrive at baths of an hour; not, as it is said, to allow the mineral to enter the system gradually, for there is no mineral to enter, but to accustom the system gradually to the action of the baths, so that at length the full action of the water may be obtained. After the second or third week of this system, reaction begins to appear, the torpor of the paralysed limbs begins to abate, unwonted heat is experienced in the course of the nerves of the paralysed parts, and then the abdomens of the patients begin to feel as if released from severe pressure; then douches are sometimes used. By these means baths and douches are sometimes continued for six weeks, and generally with the best effects. The cures effected by this treatment, according to Professor Heim, are not confined to cases of paralysis of the lower extremities, but it has often succeeded also in paralysis of one-half the body. He says, speaking of the effects of the baths, "that the Wildbad waters are apt to produce reaction, attended with profuse perspiration; sometimes restoration to health is accompanied with no reaction, but when the disease is obstinate, there is a greater struggle in the constitution, attended with considerable fever, disorder of the secretions, irritation of the nervous system, full pulse, restless nights, distressing dreams, loss of appetite, dry, hot skin, occasional hæmorrhagic discharges, purging, gouty attacks, cutaneous eruptions, which precede a restoration to health." The kidneys, next to the skin, show the greatest susceptibility. Most benefit will be derived in gout when the urinary secretion is high-coloured. According to the practice of the mass of German practitioners at spas, a prodigious number of diseases are enumerated as curable at Wildbad—rheumatism, cutaneous diseases of course, neuralgia, chlorosis, scrofula, etc. One is astonished that there is a single sick person left in the world, and, as they almost all profess for themselves, through the agency of some particular water, to make the old young, that any one should choose to die.

The usual precaution concerning the use of these waters in plethoric cases would seem to be particularly needful at Wildbad.

# CHAPTER XIII.

Kissingen (Bavaria), a rising Watering-place, now perhaps the most fashionable in Germany.—Importance of Salt.—Battle between the ancient Germans for the possession of the Salt Springs.—Discovery of the Maxbrunnen and Pandur. — Analysis of the Maxbrunnen. — The mode of administration of Kissingen Waters, and their properties.—Sovereign in Abdominal Diseases, Tabes mesenterica, and Gout.—Mode in which the Kissingen Baths are prepared.—List of Diseases said to be cured by Kissingen.—Bocklet, Bruckenau, Heilbrunn.—Gastein a remarkable Water.—Origin of the Waters.—Chemistry can make nothing of Gastein.—Effects of the Baths on the system.—Supposed presence of arsenic in Gastein.—Conjecture of Paracelsus.—Effects of Gastein in Paralysis.—Effects of Gastein Waters on Animals.—Diseases treated at Gastein.—Gleichenberg.—Ischl.—Baden (Austria).—Karlsbad.—Description of the Springs ; Baths.—Analysis of Karlsbad Water by Berzelius.—Karlsbad Water used in drink chiefly.—Case of Dr. De Carro.—Use of the waters in Liver diseases.—Resemblance in some respects between the action of Karlsbad and Cheltenham.—Action on biliary calculi.

## KISSINGEN (BAVARIA).

THIS celebrated watering-place—daily becoming more famous—can be reached by railway from Frankfort to the station of Schweinfurt, whence the conveyance to the place is by omnibus. This place is situated in Lower Franconia, twelve leagues to the north of Wurzburg, and six to the south of the almost equally celebrated watering-place of Bruckenau, in the centre of a fertile valley traversed by the Saale. It is environed by vine-covered hills.

This part of Germany has been known from very remote times for the abundance of its saline resources. According to Tacitus, it was here that a great battle was fought between the Hermanduri and Catti, A.D. 59, during the reign of the

Emperor Nero, for the possession of a region so rich in salt. The value of this article has been appreciated in all ages, quite as much by savage as by civilized man. Perhaps more so; for it would almost seem, from the extreme eagerness of savages for salt, as if the value of this article became greater as the resources of diet were diminished.* In 823 two *salines* were spoken of. Since then the Maxbrunnen and the Pandur began to attract attention. From the year 1544 there is more positive information the Maxbrunnen came into use internally, the Pandur externally; but the place only got much reputation when the Ragoczy was discovered in 1737. At this period, to defend the Pandur against inundations, a new bed was made for the Saale, and the Ragoczy sprang up in the old bed.†

The fame of Kissingen is now such that it may be regarded as on the road to be, if it is not already, the chief watering-place of Germany; strange career, if such a term may be applied, of spas, like that of cities, nations, empires—

"Nations melt from power's high pinnacle
When they've felt the sunshine for a while."

Think of the former glories of Spa, of Pyrmont; in our country of Tunbridge, Epsom; of the departing splendour of Wiesbaden, and now of the rising star of Kissingen! What is the inference to be drawn from all this?—on the face of it, that mere fashion and caprice have much to do with the reputation of all spas, and that very great critical acumen indeed would be requisite, in any case, to separate real merits from those which are assumed. The sources of Kissingen are all cold, having a temperature of about 50° or 52°.

There are three principal sources—the Maxbrunnen, the

---

* I read lately that fines are adjudged to be paid on the coast of Africa in salt. Of a rich man the Africans say he eats salt. Trona, natron, the carbonate of soda, produced largely by some lakes in Tripoli, is sent into the interior to supply the place of salt.

† *Kissingen, ses Eaux Minérales et ses Bains.* Par F. Antoine Balling, Médecin aux Eaux Minérales de Kissingen.

Ragoczy, and the Pandur. The Maxbrunnen is opposite the front of the kursaal. The two others are close together in the middle of the promenade. The most important of them all is the Ragoczy. It is received in a well, whence it escapes boiling, at a depth of some feet, through pebbles and basaltic stones. It is perfectly limpid, and the bubbles of gas may be seen to burst through it. It has no smell, but an acidulous taste, and a somewhat bitter *après goût.* Exposed to the air, it leaves behind it a reddish sediment. Its contents are in the pint—

| | | |
|---|---|---|
| Solids | 95·76 | grains. |
| Chloride of sodium | 70·768 | |
| Chloride of magnesium | 7·453 | |
| Carbonate of lime | 4·034 | |
| Carbonate of iron | 0·707 | |
| Bromide of magnesium | 0·789 | |

And other ingredients of minor importance.

It will be observed that the quantity of bromide of magnesium is very considerable. The Pandur differs from the Ragoczy chiefly in containing less solids and less iron. Both these waters are largely charged with carbonic acid; the Ragoczy containing nearly its own volume, and the Pandur rather more than its volume. The Maxbrunnen is the weakest of these three springs, containing only 30½ grains of solid ingredients in the 16 ounces, and 31 cubic inches of carbonic acid, and no iron.

The Maxbrunnen is not even covered by a roof, and is now hardly considered as a mineral water at Kissingen, which is the more extraordinary, as we shall see soon that, only a short time ago, it was thought capable of curing almost every disease.

"It is early in the morning that the patients are accustomed to repair to the sources. The signal of awakening has been given them by a troop of musicians, which every day, at five o'clock, perambulate the town, making the air re-echo with their rattling fanfares. Whilst the Maxbrunnen remains deserted, what animation and what movement around the Ragoczy! The balustrade which surrounds the spring is literally besieged by the drinkers to such a point, that those employed to distribute the water (*gens de service*), hardly know to whom they should reply." Some drink the water, such as it is, from the source, others allow a portion of the carbonic acid to escape, by putting the glass in boiling water. After drinking the water every one goes and walks, either in the alleys of the park or the long galleries of the kursaal, and then returns, and in a quarter of an hour drinks another glass. This lasts for two or three hours, and in the evening, from six to eight o'clock, the same thing occurs; but the Pandur is then preferred. Not being so strong, it has less effect upon sleep.

The question now is, what are the properties of these Kissingen waters? There are other waters, as we shall see directly, besides those already mentioned.

The properties of the Kissingen waters are closely connected with their chemical constitution. They are laxative, tonic, and alterative. The first effects are tonic; the appetite is increased and the circulation accelerated; but, as the mineralized waters are absorbed into the system during the continuance of the course, another series of symptoms begin to manifest themselves—symptoms which depend upon the exertion of the influence of the water when absorbed into the system. These symptoms are all connected with the alterative action of the chemical elements of the water. They are manifested on all the products of the metamorphosis of the tissues. The abdominal excretions show the presence of bile. Those of the kidneys of those sediments which assure us that a greater quantity than usual of urea and the urates is discharged. Even the secretion of the mucous membranes of the bronchi is augmented. The perspiration is increased, and night-sweats are common; and as, under this eliminatory process, the system may not always have sufficient power to bear up, very often a state of physical weakness and languor may accompany this secondary and constitutional operation of these powerful waters.

The chief use of the Kissingen waters is unquestionably in abdominal affections. The following passage is so much to the purpose, and relates so much to the action of mineral waters generally, that I think it best to translate it:—"These waters are sovereign in abdominal affections (I know none in this respect which are comparable to them), whenever there exists a depraved state of the *primæ viæ*, or it is necessary to combat atony and debility of the intestine. You will prescribe them with equal success against certain serious diarrhœas and against certain obstinate constipations. How can a mineral water suit in such opposite circumstances? The explanation appears to me very simple. In fact, the *inertia* which affects the intestine does not alike affect the different membranes of this viscus. Sometimes it especially attacks the mucous membrane; whence results a sort of laxity of the vessels, and, in consequence, a passive increase of all the secretions; at other times, on the contrary, it has more to do with the muscular coat, whose contractility is diminished or even suspended. In the first case, there is diarrhœa; in the second, constipation. And nevertheless, notwithstanding the difference of the symptoms, both states recognize, for point of departure, the atony of the intestinal canal. It is in fortifying this important organ, and in modifying its vitality, that Kissingen water re-establishes regularity in its functions and regulates them.

"Let us remember, on this subject, that the Kissingen waters contain, beside the muriatic salts, a notable quantity of carbonic acid and iron. And the presence of these principles counterbalances, in the happiest manner, the perhaps too enervating action of the chlorides."

In the long convalescence which results from severe attacks of such diseases as typhoid fever and cholera, where simple chalybeate waters may be too strong for the still irritable state of the intestine, where merely gaseous waters would be too weak, where it is still necessary to regulate the bowels, and produce a somewhat alterative effect, the waters of Kissingen, at once aperient, alterative, and, in such states as those referred to, we might almost say antiseptic, find a decided place. The salts, the iron, and the carbonic acid are all happily blended.

Dr. Balling, in the work to which reference has been already made, and to which I shall have to refer immediately in a more extensive manner, has said an excellent thing when he observes that chloride of sodium is to digestion what oxygen is to respiration. If it is not *quite* true, it is well said, according to the Italian saying.

The following observations of Dr. Sutro, on the class of liver diseases likely to be benefited by Kissingen waters, are well worthy of attention :—" Hepatic disease is alleged and proved to be the principal disease curable by the Kissingen waters. How then are we to distinguish between them? If you will bear in mind the individualities which we have pointed out peculiarly adapted for either of the former, then Kissingen must furnish the greatest chance of recovery if a person be afflicted with a very tender alimentary tube, with frequent flatulence and eructation, want of appetite, alvine obstruction, general debility, emaciation, or scrofulous puffiness; in short, if he require neither the highly stimulating and penetrating efficacy of Karlsbad, nor the antiplastic and derivatory power of Marienbad, nor the tonic, solvent Marienbad springs, but improved digestive action and heightened lymphatic circulation and nutrition."*

What has been said of the action of Kissingen on the liver applies to a great extent to other abdominal organs—the spleen, the kidneys, the pancreas, etc. Where there is congestion of an organ the resolvent properties of this water come into play.

In tabes mesenterica, that affection of young persons depending on scrofulous disease of the mesenteric glands, the Kissingen waters have been much praised, and no doubt justly, since, in fact, it would be difficult to select a combination more likely to be beneficial. The alterative properties of the chlorides, the stimulant action of the gas, and the tonic properties of the iron, are alike suitable for such cases.

---

* Sutro's "Lectures on German Mineral Waters," p. 189.

Gout is one of the diseases in which the waters of Kissingen are likely to be beneficial. The cases of gout most likely to be benefited are those in which the affection is more combined with disease of the abdominal organs. In all the forms of gout which present this character, that is to say, are accompanied with symptoms of diseased liver, red sediments in the urine, tumefaction of the abdomen, and, at the same time, with hypochondriacal disease, these waters are likely to be useful. It is in such cases, again, that we hear of the useful effects of a spa in producing piles. This idea of the Germans appears continually in all the accounts of the effects of their spas. The waters of Vichy tend to modify chemically the active principle of gout; those of Kissingen to act vitally upon the system, so as to alter its *modus operandi*, to use a technical phrase, and render gouty formations unlikely.

Dr. James supposes that it would be a very good thing for a gouty or calculous patient to change alternately from Vichy to Kissingen, to get the chemical modification, as it were, of his system effected at Vichy, and the alterative at Kissingen. He looks upon Vichy and Kissingen not as two opposite systems in the treatment of disease by mineral waters, but rather as the complements of each other, since the one furnishes what the other could not.

The other two famous springs at Kissingen are the Soolensprudel and the Theresienbrunn.

The baths at Kissingen are made of the water of the springs, with often the addition of a certain quantity of the mother-water of the Soolensprudel. This water is so impregnated with salts, that sixteen ounces contain 171·85 grains, principally of the chloride of sodium. The flux and reflux of this spring are quite extraordinary. After a kind of subterranean bellowing, the mineral water boils up, and a large quantity of gas is disengaged. This spring has a temperature of 66·2°. Taken internally it acts as a powerful purgative, and may be considered as something between sea-water and the Ragoczy.

The Theresienbrunnen, which arises near the Soolensprudel, is very similar in composition to the Maxbrunnen, but very largely charged with carbonic acid gas. Its chief use is in the treatment of chest affections.

Perhaps I cannot do better than quote from the work of a thorough believer in Kissingen waters. He says—"These mineral waters may be arranged in a particular order according to their efficacy; first the Maxbrunnen, feebly excitant, then calmative; the Pandour, resolvative, favouring secretion; the Ragoczy, alterative and fortifying; the Soolensprudel, penetrating and strongly resolvative; the earth bath uniting all these properties, and others besides quite peculiar."*

He then goes on to ask where in the world besides is there such an assemblage of salutary baths? I shall answer, at Harrowgate. Harrowgate has not thermal springs, nor waters highly charged with carbonic acid, as is the case with Kissingen; but it has highly sulphuretted waters, alterative and tonic springs.

Dr. Balling gives a list of diseases curable by Kissingen waters. It is like a trial where the water is defendant, but where we are pretty sure how the verdict will go, always for the defendant. First rheumatic affections are enumerated; then we are told when the disease is chronic the waters *never* fail: then are enumerated scrofulous affections in young females, hæmorrhoids, gout, hypochondriasis, hysteria—here they have succeeded where Ems has failed—melancholy (alas! if they can cure *that*, they must be possessed of prodigious power), asthma. He divides diseases of the stomach into two classes, those characterized by too great sensibility and irritability of the nerves of the stomach and those characterized by inert and painful digestion; and, after some little hesitation, decides that the Maxbrunnen and Ragoczy will cure both.

---

* Balling, op. cit., pp. 34, 35.

We then have the formidable heading, "Diseases of the Liver, Spleen, Pancreas, and Veins." First we must mention all the morbid states in which the secretion and excretion of the bile are interrupted in any manner. In biliary and renal calculi Kissingen has not been appreciated as it deserves.

In diseases of the uterus and ovaries, in sterility, in diseases of the nerves, especially if they depend upon some deep-seated affection, no water, we are told, is so favourable as Kissingen. To go further through the list is unnecessary; it is fortunate that we have the chemical element to clarify the therapeutical. The waters of Kissingen are strong saline waters, impregnated with a large dose of carbonic acid, and possessed of the properties to be looked for in such a case; and when that is said there is no further room for observation.

In the vicinity of Kissingen are many walks and rides, but the favourite walk is to the Soolensprudel, to see that astonishing phenomenon of nature.

### BOCKLET (BAVARIA),

Is a village close to Kissingen, and which contains several chalybeate springs. The chief springs are the Ludwigsquelle, the Schwefelsquelle, or sulphur spring, which, however, contains very little sulphur, and the Stahlsquelle. They are all saline, acidulated springs. The so-called sulphur spring has merely a trace of sulphuretted hydrogen. The Ludwigsquelle contains forty-five grains to the sixteen ounces. The waters are used both in drink and baths. Bocklet is a pleasant place; a great part of the population present a Jewish physiognomy.

### BRUCKENAU (BAVARIA).

Bruckenau is only distant a few hours from Kissingen, to which it almost seems naturally related, since the tonic properties of Bruckenau seem exactly the complement of the waters of Kissingen. The chalybeate, it is true, is not strong, containing only about a quarter of a grain in the pint, but no less than its volume and a half of carbonic acid gas, although with hardly any salts. It is, therefore, a pure carbonated chalybeate water; and, from what has been said of other waters of the kind, it may be considered probable that the carbonic acid imparts more than usual activity to the iron. The place was a favourite of the late King of Bavaria, who built there a magnificent kursaal: since then, the King having ceased his visits, the waters are less frequented, and the place presents another instance of the power of fashion in ruling the destinies of spas.

### HEILBRUNN (BAVARIA).

This village is only eight miles from Munich. The spring is called Adelaidesquelle; it is a cold saline spring, strongly impregnated with bromine and iodine, and gaseous. If the reader will peruse again what is said of Woodhall Spa, and of Kreuznach, he will readily be able to appreciate what are the virtues of Heilbrunn.

Liebenzell is a thermal saline water, employed chiefly in nervous affections, and although more mineralized than Wildbad, much milder in its action. Deinach, a tonic chalybeate, buried in the depths of the Black Forest. The latter is a saline chalybeate of no mean pretensions. Cannstadt is another water of nearly the same character, that is to say, a saline chalybeate.

### GASTEIN (AUSTRIA).

This remarkable water is best reached from Salzburg. The country in which it is situated is not surpassed for beautiful scenery by any other in Europe; it seems, indeed, as if nature made a point in general of accumulating her choicest treasures in one mass, and so those powerful waters are almost always *located* (to use an American phrase) amid extraordinary scenery. The houses of Gastein, seated in the finest region of the Tyrol, are grouped around the fall of the Enz, an astonishing cascade, perhaps the finest in Europe.

There are six springs, which vary in temperature from 102° to 116°; they all spring from the granite, and appear to come from the same source. The most elevated spring is that called the Prince; it proceeds from a vaulted passage made into the mountain. Its waters, united to those called the Doctor, furnish a supply to the four principal establishments of baths, which are the Hotel Straubinger, the Prélature, the Provinciale, and the Solitude. The Hotel Straubinger may be regarded as the kursaal of Gastein.

From the middle of the cascade springs a source, whose vapour can be seen through the foam of the torrent. Temperature 96·8°. Pipes carry it to a pond at a little distance, where it is used to bathe horses.

Two other sources are found to the right of the cascade, but on an inferior level than the preceding. The principal, called the Great Source, has a temperature of 118·6°, and is remarkable by its great abundance. It supplies the two large piscinæ of the hospital, several private baths, and sends a large supply of mineral water to the village of Hof Gastein, distant a league and a half, through wood pipes. At the bottom of the valley is the source of the Baker, which has a temperature of 102°, and is distributed to two common baths of this name. All these waters united furnish no less than 124,000 cubic feet of water in the twenty-four hours. As these waters are for the most part too hot to be employed in baths, they are allowed to cool in vast reservoirs. The baths are a kind of wooden cells buried in the ground, and with a place to sit on during the period of the bath.

Gastein water springs from the rock pure and brilliant, and without smell or taste; exposed to the air it undergoes no alteration.

Chemistry has been yet able to make nothing of the water of Gastein; there are only a few traces of salts, hardly equal to what ordinary spring water contains. Berzelius declared that it was almost distilled water! and yet medically, according to evidence which it is impossible to overlook, how far does this water differ from distilled water?

The effects of Gastein are so wonderful, that one would almost wish, for the sake of science, that the rumour which we have heard may be correct; for it is reported that arsenic and gold have of late been found in Gastein. Paracelsus—with that strange foresight, a species of ratiocination which often accompanies genius*—long ago conjectured the presence of arsenic in Gastein. It has been often looked for. Still, even if arsenic and gold were found, all explanation of the extraordinary effects of this water would not be over; for we have seen that arsenic is found in other waters, as for instance Vichy, which yet have nothing of the effects of Gastein.

The first effect of a bath of Gastein at the temperature of 90° to 92°, which is the common temperature, is a sense of constriction of the skin of the *whole body*. Then comes on unusual heat, with shocks and quiverings, which spread over the whole body; the pulse at the same time becomes hard and frequent, the face acquires colour, the ears beat. "Hasten," says one writer, "to leave the bath, there is danger in too long a stay." And all these effects from a water almost chemically pure!

At a little distance from Gastein, in the valley of Bockstein, are mines of copper, gold, and silver, highly arsenuretted. There is even a Lake Pockart, called the poisoned lake, whose waters contain arsenic in such quantity that no fish can live in it—no plant grow on its margin. The waters of Gastein, too, when swallowed, cause nausea and vomiting. It is the custom, after a bath of Gastein, to go to bed and rest for an hour; but, contrary to the effects of other baths, perspiration is not produced; on the contrary, the skin is rendered more close, and these baths are remedial in persons too much troubled with moist skin. After a while the stimulating effects of the water become concentrated on the nervous system. This is particularly shown in the extraordinary aphrodisiac effects produced by the water in both sexes. The celebrated Kopp has related himself the manner in which these waters restored existence to him:—"Affected with cruel and continual suffering towards the brain, and feeling at once his intelligence become weakened, his memory extinguished, and life, as it were, leave him—in fact a commencement of softening of the brain was feared—he fell into a profound hypochondriasis. After having tried various remedies in vain, he repaired to Gastein. The first year procured him notable relief; a second year passed at the same sources enabled him to recover health and the possession of his high faculties."*

---

* If he had had learning, says Morhof (Polyhistor), with which to adorn his doctrine, "non habuisset Germania majus nomen."

Paralytic affections, especially of the lower limbs, receive almost miraculous succour in Gastein. These waters, so often compared to Wildbad, are even more active as regards the nervous system, especially in cases where the paralysis has to do with organs representing the energetic *natural powers* of life. The effects of many waters can be explained to a great extent by their chemical constitution, their high temperature, but Gastein is used almost tepid, and contains hardly any mineral. One peculiarity about Gastein is, that the waters do not appear to lose their power by being transported to some distance. At the village of Hof Gastein the baths are found to be as efficacious as at the place itself.

That Gastein has been successful in many cases of paralysis of the lower extremities is undoubted. In paralysis of one-half of the body, the more difficult kind to treat, its success is doubtful. There are always at Gastein a number of young men who come to seek the recovery of the "joys which youth has squandered;" and if all tales be true, not without frequent success.

The waters of Gastein, being so peculiarly stimulant, require great pains in their administration. As a general rule they suit weak and lymphatic temperaments, and are highly injurious in those which are excitable and sanguine. So much is this the case, "that Dr. Proell, one of the most distinguished physicians of Gastein, said to me, when it was in question to send any one to these waters, he always made a point of inquiring his character; was he angry and obstinate, this would be a contrary indication." The duration of the treatment is subject to the same kind of considerations. With people of a sanguine, impressionable character, fifteen or twenty baths will be enough; whereas twenty-five or thirty will be required for phlegmatic people. The patients themselves are good judges. When their systems are saturated, as it were, with the treatment, the bath becomes hateful to them. I quote the following from the work of M. James:—

---

* Dr. James.

"What I say here of the necessity for the physician of studying, above everything, the character of the patients, is confirmed by the mode in which the animals themselves are affected. Let us observe what takes place with horses bathed in the pond fed by the source of the cascade, and whose water has only a temperature of 67° or 68°; whilst they work, the baths recruit and give them fresh strength; but if they are idle, they offer all the signs of extreme excitement. The animal, which was before difficult to manage, becomes unapproachable. That which was naturally calm and peaceable, begins, without cause, to strike and bite. They never sleep; many are seized with an erotic rage. They must be set to work again to get rid of this exuberance of strength, or the baths interrupted. In face of similar facts, will any one assert that the action of mineral waters is simply an affair of imagination?

Among the diseases treated at Gastein may be mentioned especially atonic gout, old wounds, fractures, and dislocations. Chronic rheumatism, too, is one of the diseases for which Gastein has much renown. During the height of the season such is the throng of visitors that the patient intending to bathe should write to Herr Straubinger, the chief hotel-keeper, or to one of the physicians at the place, five or six weeks before, to secure a place, or he may risk the want of a lodging, have to stay at Hof Gastein, or even at Salzburg.*

### GLEICHENBERG (STYRIA).

These waters are cold alkaline waters, highly charged with carbonic acid, situated six and a half miles from the town of Gratz. They contain in the pint about forty-six grains, of which nearly one-half is the bicarbonate of soda, taking the principal source, or that called Constantine. Its other constituents are carbonates of lime and magnesia, and chloride of sodium, and a very large quantity of carbonic acid. The spring Constantine is exceedingly similar in composition to Ems; and, in fact, its properties are very like those of that celebrated spa. It is chiefly famous in consumptive cases, especially in pulmonary catarrh and commencing tubercle. It is customary to drink it along with milk. There are other sources as well as that called Constantine.

### ISCHL (AUSTRIA).

Ischl, much more known in the political world than as a mineral water, is a town in Upper Austria, not far from the Tyrol, towards Styria and the Bavarian frontier. The place is prettily situated on the borders of the Traun, amid gardens and woods, in a kind of amphitheatre, surrounded with mountains, which shelter it well from the north winds. The running streams which everywhere circulate through the valley, by keeping up currents of fresh air, tend also to promote the salubrity of the place. For the sake of the air, rather than any benefit from the waters, the Court of Austria makes a practice of visiting Ischl. In fact, Ischl is not, properly speaking, a spa, but a saline water, far stronger than the sea itself, containing nearly twenty-five per cent. of solids. So strong is this water that in its concentrated form it is not even used externally; but ten parts of it are added to three hundred of water, and the dose is increased to fifty in three hundred. It is unnecessary to enter at length into the description of the properties of such a water. We might as well speak of those of common salt itself, of which Ischl is as nearly as possible a pure solution. Butter-milk is much drunk at Ischl; and it is for that, as much as the baths, that the place is frequented.

---

* Gastein is 3200 feet above the sea.

Many women repair to the place, which has a certain reputation for the cure of nervous affections and diseases of the womb. Even baths of butter-milk are in use.

### BADEN (AUSTRIA),

Called by the Romans Aquae Pannonicae, a charming little town, four leagues from Vienna. It bears much the same relation to Vienna that Enghien bears to Paris; both are sulphurous, but Baden is thermal, having a temperature as high as 104°. At Baden there are about twenty sources, and over each is an erection. At every one almost is a large public bath, where the bathers can walk up to the arm-pits, and every one of these baths is supplied with a constant stream of water. These public baths are most used; nevertheless, there are private baths. Baden has also a double school of swimming; one for men and another for women, which, in fact, form almost lakes, ten or twelve feet deep. It is a kind of naumachia, open to the heavens, and with a bottom of sand. The water exhales an odour of sulphuretted hydrogen; is quite limpid, and of course tepid. The source which fills the baths is the Ursprung, which springs in the middle of the public promenade. It is so abundant as to furnish, every twenty-four hours, about half a million gallons. The waters are used in paralysis, scrofula, wounds, and catarrhal affections. As a spa, they are not of great importance, containing only a moderate quantity of salts, and a cubic inch of sulphuretted hydrogen to the pint. Near Vienna is also Voslau, another station similar to Baden, where also are swimming-baths.

## KARLSBAD (BOHEMIA).

This most important spa is situated in a deep valley, between granitic rocks, surmounted with wood-covered hills. In the middle of the valley runs the little river Teple, whose bed, in summer, is sometimes dry. The room occupied by the town being very much restricted, the greater part of the streets are very confined.

There are several springs at Karlsbad. They have appeared and disappeared, as has already been shown, earthquakes having from time to time affected them. At present ten sources are reckoned. The chief is doubtless the Sprudel, which indeed has been termed the Queen of all the mineral waters of Europe. This water discharges itself from the soil by a large orifice, bounds and boils, and then falls back in foam. Its temperature is nearly 167° of Fahrenheit. A cloud of vapour envelopes it on all sides, and joined to the noise which the water makes in falling, announces its presence. This spring is in the centre of the city, on the right bank of the Teple, and at the end of a large pavilion, near a covered gallery, which serves as a promenade for the patients. Beside the Sprudel is the source of Hygeia, not so hot or so plentiful. The other sources of Karlsbad are on the right bank of the Teple, and on descending the river. They are the Schlossbrunn (Castle Bath), the Marktbrunn (Market Bath), the Mühlbrunn (the Mill Bath), the Neubrunn (New Bath), the Bernardbrunn (Bernard's Bath), the Theresienbrunn (Theresa's Bath), the Felsenbrunn (Rock Bath), and the Spitalbrunn, or Hospital Bath. The temperature of these varies from 122° to 197°. These waters are almost all brought into little pavilions, not devoid of elegance. All these waters resemble each other in composition. They differ only in their temperature. All come from some prodigious internal reservoir. The calcareous envelope is the result of the precipitations of the solid contents of the water for ages, and on this envelope Karlsbad is built. The analysis of Karlsbad water, by

Berzelius, has been generally looked upon as a model. It was fit that the chief water in Europe should be analysed by the first analytical chemist, I therefore give the analysis as it is, without translating its weights and measures into English. In a litre—

| | | |
|---|---|---|
| Carbonic acid | 0·40 | $\frac{4}{10}$ths of its bulk. |
| Dry sulphate of soda | 2·58713 | grammes. |
| Dry carbonate of soda | 1·26237 | |
| Chloride of sodium | 1·03852 | |
| Carbonate of lime | 0·30860 | |
| Carbonate of magnesia | 0·17834 | |
| Silex | 0·07515 | |
| Carbonate of iron | 0·00362 | |
| Carbonate of manganese | 0·00084 | |
| Carbonate of strontia | 0·00096 | |
| Fluate of lime | 0·00320 | |
| Phosphate of lime | 0·00022 | |
| Phosphate of alumina, with excess of base | 0·00032 | |
| | 5·85927 | |

Since Berzelius wrote, iodine and bromine, as well as arsenic, have been discovered in the water.

Although the waters of Karlsbad differ only by their temperature, they have very different effects on the economy. And here there comes an observation which, in connexion with the views already advanced in this work as to the cause of the intimate action of thermal waters, appears of the greatest importance. I extract the passage from the work of Dr. James :—"A very remarkable fact has been mentioned to me by M. Hochberger, one of the most distinguished physicians of Karlsbad, that, in certain patients, towards the last days of the cure, an extraordinary electric state is developed, such as exists naturally in the cat. In passing the hand through their hair sparks are given out. Do these waters contain some fluid analogous to the electric, or do they possess the power of setting afloat the electricity of our systems ?"

The Karlsbad waters are especially employed in drink.

The general practice is to repair to the spring at six or seven o'clock. The water is too hot to be drunk on the spot without allowing it to cool. The quantity of water drunk depends very much on the taste of the patient. The fashionable sources now are the Mühlbrunn and the Sprudel. Some will drink ten or twelve glasses. The first effect is purgative; then follow diuretic symptoms, doubtless from the absorption of the water into the system. Indeed, the absorption of these waters appears to take place with astonishing rapidity, and to be accompanied with an unmistakeable series of symptoms: heat of skin, acceleration and fulness of the pulse, sometimes a kind of febrile state.

Dr. De Carro had pulmonary symptoms which he attributed to misplaced gout; he commenced the waters at the Neubrunn. "During the first three days he felt no effect whatever. He had been unable to get further than seven goblets daily, but on the fourth day he felt as if he were drunk, lost his appetite, staggered on his legs, had indistinct visions, burning cheeks, excited and agitated circulation, overwhelming drowsiness, and total inability to read or write. These violent symptoms continued for three days, and were much mitigated by copious evacuations; and, the storm having subsided, he continued the waters for six weeks without further inconvenience. The bowels became regular, and there was a copious but fœtid secretion from the kidneys the whole time. All the symptoms of misplaced gout disappeared." M. De Carro observes, that, had he not been a physician, he would have looked on the above symptoms as forerunners of apoplexy. Upon which Dr. James Johnson observes that he is quite satisfied they were such, and that, but for the evacuations spoken of, M. De Carro would have furnished, *in propria persona*, an example of the powers of Karlsbad water.

It is a curious thing with regard to these waters, once almost entirely used as baths, that now their use is just as much peculiarly internal.

There are two great classes of diseases in which Karlsbad is especially used; the first are liver and abdominal diseases; and the second biliary and calculous affections.

It is curious how soon the writers on mineral waters are glad to drop their language in speaking of weak springs—although I, as well as others, admit, when speaking of Buxton, Wildbad, and Gastein—perhaps, as we shall soon see, of Pfeffers, that in many of the thermal waters there are properties which cannot, by any ordinary mode of reasoning, be explained; but it is curious how pleased almost every writer seems to get hold of a tangible fact, thus, Dr. James says, as I think some writer does before him, "Il n'y a pas à Karlsbad de sources faibles;" there are no weak waters at Karlsbad. For this reason Dr. James thinks that patients are too carelessly sent to Karlsbad, without sufficient consideration of the power of the water. The phenomena of the thermal fever are nowhere brought out to the same extent as by the waters of Karlsbad, and if the constitution be not in a fit state to undergo the reactionary effects, the consequences may be indeed serious.

In fact these waters, penetrating slowly and gradually the organs of secretion, are, perhaps, except preparations of iodine and mercury, and such like powerful remedies, as active alteratives as could be selected from the mineral kingdom, and as such they should be used.

To the slow alterative effects of the waters of Karlsbad are owing the curative power they exercise in liver affections, especially in cases of old Indian disease, where they hold a place by the side of Cheltenham. Patients will come to Karlsbad with a liver so enlarged that it seems to fill the whole abdomen, a yellow countenance, an emaciated frame. Under the influence of the mineral water the liver will rapidly diminish in volume, the countenance assume its proper expression, and the appetite become again established. Such are the ordinary effects of Karlsbad water in these cases. The mode in which enlargements of the liver subside under its use is something extraordinary. The same applies to diseases of the spleen and other abdominal organs.

In gravel the waters of Karlsbad have long enjoyed a very high reputation. "It is not doubtful," says one writer, "but that they can either dissolve irritable calculi, or give them a friability which promotes their expulsion. Among the numerous cases of this kind, I recollect that of Dr. Bigel, of Warsaw, which he has related to me himself, in a memoir full of authentic and interesting facts. This physician, after having undergone, without success, at the age of sixty-four years, the operation of lithotrity, came to Karlsbad to drink the waters; these softened the stone, reduced it, and expelled the last fragments, so that from that time henceforth he never experienced an attack."*

Biliary calculi are also attacked by these waters, and with more energy than even the calculous ones. Some of the calculi of this kind expelled have a blue colour. Gouty affections are of common occurrence at Karlsbad. The Karlsbad waters favour the elimination of the gouty principle; and, if they cannot thoroughly cure the disease, render the attacks shorter, and promote the solution and disappearance of gouty concretions. Even joints become almost immovable by deposits of this morbific matter of gout, recover their mobility. In diabetes, Dr. James looks upon the water of Vichy as more likely to get rid of the morbid principle than to restore the tone of the system, and thinks Karlsbad more likely to have this effect. A crowd of hypochondriac patients are always found around the sources of Karlsbad. I have already given a good number of the numerous diseases in which the waters have been recommended; it is quite as important to state the cases in which their employment would be injurious. There is a sameness in these contra-indications which must strike the reader. The fact is that almost all mineral waters are contra-indicated in actual cases of organic disease; they are generally, with a few exceptions, of an excitant character. Thus, whenever there is what medical men call a sthenic state of the system, meaning an excess of tone or force, those waters for the most part are injurious. In actual organic disease, very often attended with inflammatory symptoms, the case is a little different. Here these waters can hardly do good by curing the organic disease, and may do harm by exciting the inflammatory symptoms. When the organic disease affects very important organs, as the brain, or concerns the heart or great vessels, then the mischief from any great excitement may be serious indeed. This applies also to all malignant cancerous affections. These are general principles which should be modified in particular cases.

---

* Dr. James.

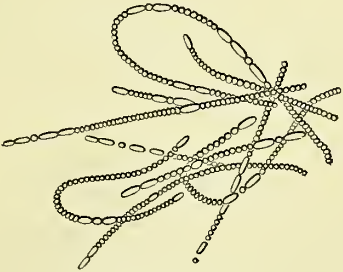
At Karlsbad in particular, among German spas, great attention to dietetic rules is enjoined, and the *tables d'hôte* are served in accordance with the regulations of the faculty. Exciting meats and drinks, champagne, and such like, salted meats, cheese, acid fruits, are rigorously excluded, while by the wise regulations of the Government, as the faculty regulate the diet, so the recreations of the company are kept within the bounds of decorum. Games of hazard, so publicly allowed at many of the German watering-places, are forbidden. The place is considered as being essentially one for the residence of patients; and although balls and such assemblages do take place at the kursaal, they do not constitute one great feature of the spa, as at other German watering-places. The principal recreations indulged in are the rides and walks in the charming neighbourhood of the town.

It may be well here to say a word concerning the exportation of mineral waters, those of Karlsbad being exceedingly well adapted for this purpose.* We have seen that they are used at other watering-places, as at Baden-Baden. It may be simply observed, as a general rule, that those waters highly charged with salts bear exportation best; that excess of carbonic acid is no decided obstacle, seeing that several of the manufactured chalybeate and other waters, also those of Vichy, and other natural waters, can be so transported. The sulphuretted waters of the Pyrénées bear transportation worst. In cases where chalybeate waters are sent to a distance from their springs, contact between the water and the cask should be prevented, which can easily be done by the interposition of caoutchouc, or the tannin of the cask, where the water is but a feeble chalybeate, might absorb almost all its iron.

---

* They are generally drunk rather warm, like the natural water, and seldom in doses of more than half a tumbler at a time.

These central German spas may all be easily reached from Dresden.



SPHÆROZZA JACOBI,
A CONFERVA FOUND IN KARLSBAD WATERS.

# CHAPTER XIV.

Pyrmont; its former popularity.—Driburg and Lippspringe.—Marienbad; its waters called by Hufeland Karlsbad cooled.—The Kreutzbrunn and the Ferdinandsbrunn.—The former the more celebrated.—Dr. James Johnson on the baths of Marienbad.—Internal use of the waters and external use.—Abundance of carbonic acid gas baths and mud baths.—Eger.—Franzensbad.—Composition of the waters according to Berzelius.—The different waters and their uses.—Toeplitz a splendid spa.—The Battle of Kulm.—Description of the waters.—Military Sanatoria at Toeplitz.—Bilin.—The Bitter wassers.—Pullna, Saidschutz, Seidlitz.—Superiority of Frederickshall.—Analysis of its water by Liebig.

## PYRMONT (WESTPHALIA).

One of the most celebrated chalybeates, and also of unquestionable power. It has now lost much of its almost unrivalled fame, doubtless from the discovery of so many valuable springs in modern times. Pyrmont is easily reached by rail from Bruxelles, by Cologne, Dusseldorf, and Hamm, to the station of Bielefield; from thence there is an omnibus to Pyrmont. A fact in its history is worth relating, as showing the influence of fashion on spas. In 1556 such was the renown of the waters of Pyrmont, that people flocked to them from all parts; more than 10,000 people visited them in one month, and a camp had to be formed for the crowds, as the surrounding villages could not hold them. The reigning Count (Waldeck) had to make laws to regulate them. The same concourse was observed after the Peace of Westphalia, which followed the Thirty Years' War. "The superstition was such that old women had themselves transported thither in the hope of becoming young, and the roads were covered with the deaf and blind." Everything was done by the former rulers to make Pyrmont a pleasant place of abode. Noble alleys and promenades were formed, and a splendid kursaal erected. Pyrmont will still be found a very agreeable place of abode, and its fountains have not degenerated. The Waldeck, the principal source, contains 28·3 grains in the pint, of which the iron is 0·715; and there is a large quantity of carbonic acid gas, the proportion being almost double the quantity of the water, at least as 168 to 100; there is also a strong saline spring, and several other iron sources. The chief salt in the saline is the chloride of sodium; it also is highly charged with carbonic acid, containing at least its volume of that gas. The Pyrmont waters produce an almost intoxicating effect when first drunk, and the iron sits lightly on the stomach. They are generally drunk in the morning early. So much has been said of similar waters, that it is unnecessary to say much more of Pyrmont. No chalybeate waters can be superior both for the readiness with which they remedy symptoms for which iron waters are prescribed, and the rapidity with which they renovate the system. The precautions usual with chalybeate water should be taken, and some simple preparation, by using aperients previously, is necessary in the case of Pyrmont.

The waters are accompanied at their sources with bubbles of carbonic acid, which break with explosive violence; and the ground is so highly charged with carbonic acid, that there is a grotto in the neighbourhood similar to the Grotto del Cane.

Driburg and Lippspringe are two Westphalian waters; the former chalybeate, the latter saline. It is a saline of no great strength, but both are strongly impregnated with carbonic acid. The second source would rank with our English saline springs of the third class but for this circumstance. It would seem as if the impregnation with this gas not only rendered the iron springs more agreeable, and increased their energy, but that it exerted a similar influence upon the saline springs.

### MARIENBAD (BOHEMIA).

Marienbad is only six leagues from Karlsbad. It has very much the appearance of a park, over the surface and among the umbrageous groves of which a number of villas are scattered. These are the hotels where the visitors are lodged. The chemical composition of the waters of Karlsbad is so similar to those of Marienbad, excepting the thermality of the former, that Hufeland called the latter Karlsbad cooled down.

There are two principal sources, the Kreutzbrunn and the Ferdinandsbrunn. The former is the more celebrated, and much more in use than the other. "It springs in the centre of an elegant rotunda, surrounded with a triple rank of columns, which communicate with a long covered gallery, serving as a promenade to the drinkers. The water is clear, its taste piquant and somewhat saline. The contents present nothing remarkable. The contents are, in the imperial pint, 75·442 grains of solids, which are chiefly sulphate of soda, nearly 38·50; 7·50 of carbonate of soda, rather more than that of chloride of sodium, and a small quantity of carbonate of iron, but rather more than its volume of carbonic acid gas. Thus the water is an acidulated saline, with enough sulphate of soda to possess aperient qualities, carbonate of soda to make it antacid, a feeble quantity of iron, much about the same as in Tunbridge Wells, to give chalybeate properties, and a strong dose of carbonic acid, to make it an agreeable and stimulant drink. How often has the writer had to deplore the sad deficiency of our English waters in this latter respect.

The Franzensbrunnen is nearly a mile from Marienbad. In its composition it closely resembles the Kreutzbrunnen, only the quantity of salts is rather more considerable, and with a dose of nearly one and a half times its bulk of carbonic acid gas. The Caroline and Ambrosius Brunns, near the Kreutzbrunn, contain very few salts, and rather more iron than the other waters, in fact, are as nearly as possible pure chalybeates, with a strong dose of carbonic acid, the former being more acidulated than the Kreutzbrunn, less so than the Ferdinandsbrunn. These waters are very similar to Bruckenau. There are other sources—the Wiesenquelle and the Waldbrunn. The source of Maria is weak in salts, but the basin in which it spouts forth appears as if boiling with gas. The Wiesenquelle and Waldbrunn contain much of the carbonates of magnesia and lime. The Marienbrunn is almost reserved for baths. A constant atmosphere of carbonic acid exists above the water, and the experiments of the Grotto del Cane may here be repeated.*

The waters can be heated to some extent without losing their excess of carbonic acid.

The following is the account given by Dr. Johnson of the effects of the baths of Marienbad :—" On entering the bath, say at blood heat, innumerable globules of carbonic acid are seen on the surface of the body. Many people perceive a redness of the skin soon after immersion, accompanied by a sense of heat even when the baths are not above 88° or 90°. Some people of irritable and sensitive constitutions, on the other hand, experience a slight shiver, even when the temperature of the water is above that of the blood. The bath occasions a prompt and copious secretion from the kidneys. Many people who have had old wounds, fractures, and ulcers, experience pains in the parts while immersed in the water; the same may be said of gout and rheumatism : and this renewal of pain may be considered a favourable omen. Old and ill-conditioned ulcers soon assume a more healthy appearance under the use of the baths, and take on a more active, and even sometimes an inflammatory condition. Ulcers ought to be covered with oil-skin, or other defence, while the patient is in the bath. In the course of the bathing, generally after ten or fourteen days, any eruption that previously existed becomes more developed, and very often new cutaneous eruptions come out. These are to be considered as more or less salutary.

---

* The carbonic acid causes sneezing.

With regard to the internal uses of the waters, the Kreutzbrunn and the Ferdinandsbrunn may be considered as essentially alterative and resolvent waters. They are generally drunk in the morning, sometimes in the evening, and are found to purge somewhat, but to sit easily on the stomach, producing no feeling of weight. They render the urine clear, and excite appetite; some patients add milk or buttermilk to them. Their action differs from that of ordinary purgatives, in applying a gentle stimulant action to the abdominal organs. They associate themselves with the forces of the system, rather than excite them to any violent action.

They are used in very nearly similar cases to those of Karlsbad, in enlargements of the abdominal organs, calculi, gravel, gout, etc. ; they are given even to people who have had apoplectic attacks,—provided the worst symptoms are over; they are highly antispasmodic. "This water is much used in tremor of the limbs, paralysis from mere weakness, or from loss of blood, excesses or severe illnesses, distress of mind, etc.

"But it is chiefly in chronic complaints of the abdominal, and especially of the digestive organs, that the Kreutzbrunn is famous. The symptoms which indicate the use of these waters, according to Dr. Heidler and the other physicians of Marienbad, are the following:—Yellow, pale, or cachectic complexion, loss of appetite, distaste of food, sickness, furred tongue with bitter taste in the morning, acid or rancid eructations, oppression or cramps about the stomach, distension and tenderness of the abdomen, local or general colics, kidney affections, constipation, diarrhœa, dysentery, deposits in the water, irregularities of females, sterility, leucorrhœa, hypochondriasis, hysteria, epilepsy, various and anomalous nervous affections, headaches of all kinds, giddiness and vertigo, noise in the ears, sleeplessness, asthma, anxiety about the chest, palpitation of the heart, languor of the muscles, cold extremities, feeble circulation, atrophy, etc."

There is this essential, that, not being thermal, they do not stimulate like the waters of Karlsbad; and where the latter might be dangerous in internal congestions, head or heart disease, the latter may be used. They are supposed, moreover, to have a great tendency to produce that great German desire, viz. a hæmorrhoidal flux. It has been conjectured, by the way, that beer drunk to excess might have some tendency in producing the congestion of the abdominal organs with the Germans, but no nation drinks beer to a greater excess than our own, without such a state of things resulting.

The baths of the Marienbad are very handsome and well managed. In the same building are the mud-baths. These are prepared by mixing with the water of the Marienbad, first heated, a kind of mineral substance, black, friable, and pulverulent, brought from a neighbouring peat-bed, and which is probably formed by the remains of decayed vegetable substances and the earth. Salts are found mixed with it, and sometimes sulphur ; it is also somewhat bituminous. The effect of these in stimulating the skin and removing swellings cannot be doubted.

Marienbad offers great resources for the baths of carbonic acid. These baths are administered in a little building above, where the gas, mixed with some sulphuretted hydrogen, escapes from the porous soil. This action has already been spoken of. Baths of the ferruginous waters, the Ambrosiusbrunn and Carolinerbrunn are also administered, especially towards the end of the cure at Marienbad.

These resources are great, and Dr. Johnson says, "I left Marienbad with the impression that its baths and waters are among the most efficient of the German spas."

The amusements are much the same as at Karlsbad. The waters are the property of the monks of the Abbey of the Töple.

### EGER—FRANZENSBAD (BOHEMIA).

Eger, a city of 12,000 souls, is situated at five leagues from Marienbad. It has never possessed mineral waters; but many people believe that Franzensbad and Eger are two distinct mineral stations, and not the same, distinguished by two different names. It has six sources, which chemically and medicinally are saline chalybeates. All are cold, and of volcanic origin. The water is perfectly limpid, soft, and sparkling; its taste is sharp and salt, with a slight *arrière goût*, slightly styptic. Franzensbad contains, according to Berzelius, in the litre 5·544 grammes of fixed principles.

| | |
|---|---|
| Sulphate of soda | 3·234 |
| Chloride of sodium | 1·198 |
| Carbonate of soda | 0·665 |
| Carbonate of iron | 0·030* |

It is one of the most gaseous waters. In 1793, according to an inscription in golden letters, the Emperor Francis conferred on this place its present privileges.

At a few minutes from the Franzensbad is the Salzquelle and the Wiesensquelle, which are united in two large pavilions, connected by a long gallery which serves as a promenade. The first of these sources is less saline than the second, and contains almost no iron, less than the Franzensbad, but rather more sulphate of soda. A fourth source, the Neubrunn, is especially remarkable for the quantity of carbonic acid which it contains. The cold Sprudel completes the list of waters used as drink.

The Louisinquelle is almost entirely used in baths. In a vast basin a great many mineral waters are united, which produce a large quantity of gas. It is the most copious.

The Franzensquelle has a tonic and solvent action according to its constitution; it both strengthens and soothes the nervous system; it improves the circulation and colour, and increases digestion; it dissolves mucus, sometimes expels worms, but produces constipation; it acts powerfully on the uterine system; is diuretic; useful in diseases of the bronchi. In 1748 this water cured Frederic the Great of asthma with extreme debility. It is peculiarly beneficial in hypochondriasis. The Salzquelle is not so copious a spring as the Franzensbad, the latter discharging 275 cubic inches, and the former 133 per minute. It contains about thirty grains of solids, of which the constituents are very similar to the Franzensbad, except the iron, of which it only has a trace. The properties are solvent and laxative ; it suits children and women of lymphatic temperament, and is very useful in chronic catarrhs of the larynx, the chest, and urinary passages, in scrofula, and hypertrophy of the liver and spleen, as well as in certain uterine swellings.

---

* The other constituents are silex and carbonate of lime. In all, about 34 grains to the pint, with 30½ cubic inches of carbonic acid gas.

The Wiesensquelle contains some sulphur.

Franzensbad is especially remarkable for its mud-baths. The gas baths are practised as at Marienbad. The mud-baths are distinguished by the enormous abundance of the mud. Its constituents, the salts of iron, soda, lime, alumina, iron, etc., are in great abundance. It contains also humus humic, or ulmic acid. It is smooth and fat, and has a styptic flavour. The mud is usually mixed with the water of the Louisinquelle, when it forms a pasty mass like bread poultice steeped in ink. "Dr. Cartellieri has informed me that he has obtained the best effects in anæmia and chlorosis, in old rheumatic affections, in gouty deposits, in paralysis independent of an active affection of the nervous centres, in inflammation of the spinal cord, in old fractures and luxations; and in certain diseases of the skin their action is strengthening and resolvent."* Near the place is a passage which was made in an extinct volcano to explore it; enormous quantities of scoria are discovered. At Eger the room is still shown in the town-hall which is said to have been the sleeping-room of Wallenstein, and the halbert with which the Irish Colonel Devereux stabbed him.

## TOEPLITZ (BOHEMIA).

This place is celebrated in history. In its walls were assembled the allied Sovereigns of Russia, Austria, and Prussia, when, after the battle of Dresden, the allies were in full retreat. Napoleon sent Vandamme across the Bohemian mountains to intercept their retreat and gather the sword of the vanquished. He himself, however, unaccountably omitted to press the retreat of the allies, halted his guard at Pirna, and the retiring wave destroyed Vandamme and 30,000 men; a blow which turned the scale against the French.*

---

* Dr. James.

Schonau is a suburb of Toeplitz, and of no less than eleven sources, six are in the former locality. The temperature of these springs varies from 78° to 110°. The latter is the temperature of the Hauptquelle, the former of the Gartenquelle. These springs emerge from a kind of volcanic porphyry. This water is limpid and colourless, slightly green, like so many mineral waters, in the basins. It contains a fraction more, in the pint of the Hauptquelle, than 4·64 of solids, principally carbonates of soda, with carbonates of lime and sulphate of soda, and traces of manganese, silex, and iron. It is another of the waters in which the chemical composition cannot explain the properties. The waters are little drunk, but almost entirely used externally. As at Baden-Baden, waters from a distance are drunk in preference to the water of the place. The baths are splendid, as might be supposed from the princely and noble company who resort to this elegant place. Use is made both of public and private baths. The public baths are constructed, as in some other places, over the springs themselves, which continually flow in constant streams through the baths. There are some of these baths called family baths; others capable of accommodating a much larger number of persons; and some of them, as at Wildbad, with a bottom of sand.

---

* I am aware of the aphorism, *ne sutor ultra crepidam;* but did not Napoleon make a simple mistake when at Waterloo he wasted his strength on Hougoumont, a fortress for the day, instead of throwing his great strength on Wellington's left, by which the Prussians were to come, and which was completely *dans l'air?* Had Hougoumont fallen, it would not still have prevented the Prussians' advance; but had the Emperor forced Wellington's left, he would have interposed between him and the Prussians. I am not aware that this remark has been made, and it may be considered a piece of impertinence in me to volunteer it.

Important as these baths are, after all that has been said of similar natural hot baths, it will be unnecessary to dwell on them at length. Among the diseases relieved, gout, as usual, occupies a prominent place, then periodic diseases, vague pains in the joints, nervous sensations. Sometimes patients who have tried other waters in vain, find relief at Toeplitz. A great many paralytic affections, neuralgic cases, are in the same category. Prussia, Saxony, and Austria, maintain extensive military sanatoria at Toeplitz—another proof of the superior attention of their Governments to ours in a matter so important to the health of the soldier.

We are told that while Marienbad suits plethoric people, and Franzensbad cases of impoverished blood, and Karlsbad the bilious, Toeplitz is best for the nervous class of patients.

Toeplitz is called the terrestrial paradise of Bohemia. It is said that the waters were discovered in a way somewhat similar to those of Karlsbad.

### BILIN,

Two leagues from Toeplitz, possesses a sufficiently strong saline alkaline spring, containing 44·3 grains of salts in the pint, of which more than one-half are carbonate of soda. It has been compared to Vichy in all except its thermality. Being saturated with carbonic acid gas, it forms a kind of natural soda water; and, in reality, is employed throughout Austria and Germany much in that way, and especially to mix with wine.

Three or four waters now occur largely charged with salts, and those mostly of an aperient character, and as these waters are very bitter, the name of Bitter Wasser has been given them.

Pullna, Saidschutz, and Seidlitz, are situated near together on the road from Toeplitz to Kursaal. Pullna is, perhaps, the most important of the three. These waters are found in ground so impregnated with salts that it is only requisite to dig a well, water collects in it, and after a time dissolves a sufficient quantity of salts from the soil, to become charged with them. Few waters possess less of what might be termed independent or original constitution than these, or are more capable of being imitated artificially, or replaced by pure chemical substances. I must confess I see little use in prescribing these nauseous waters, when sulphate of magnesia or phosphate of soda can be combined with other substances, so as to answer every purpose of the patient. As for sending any one to drink them it would seem absurd. Pullna contains about 300 grains in the pint, chiefly sulphate of soda and sulphate of magnesia, Glauber and Epsom salts: Saidschutz is less strong, and among other ingredients, of which Epsom salts are in excess, contains sulphate of soda and nitrate of magnesia, a circumstance which shows a resemblance between this soil and that of other countries, as Bengal, which produces nitrates. The water of Seidlitz is not like the artificial water of that name, containing little carbonic acid, a circumstance which would induce me to prefer the artificial water. Seidlitz water is about half the strength of that of Pullna. In the natural salts of Seidlitz, coming from the evaporation of the water solid, the chief ingredient is Epsom salts. I repeat, I see no advantage in the use of such waters over our ordinary chemical preparations.

### FREDERICKSHALL (SAXE-MEININGEN).

This is much the most important of the *bitter wassers*, for reasons which will forthwith appear. It is situated in the Duchy of Saxe-Meiningen, and four leagues from Cobourg, in the smiling valley of the Greck. The valley rests upon strata of secondary formations, traversed by layers of shale, marl, and gypsum. There are besides layers of dolomite (carbonate of lime and magnesia), which are supposed to contribute to the formation of the water. This is not a bitter wasser, coming like the others from a kind of lixiviation of the soil, but a genuine powerful mineral spring, proceeding from the bowels of the earth. The springs served formerly for the production of salt: they were destroyed by the Hussites, but were recovered during last century, and used for the manufacture of Glauber salt and common salt, and although occasionally used medicinally, it is only of late that they have come much into use. Of late years a vast quantity of the water has been sold in all parts of the world.*

The following is the analysis by Liebig, in 1847. In 16 ounces of water he found:—

| | |
|---|---|
| Sulphate of soda | 46·510 |
| Sulphate of potass | 1·523 |
| Sulphate of magnesia | 39·553 |
| Sulphate of lime | 10·341 |
| Carbonate of lime | 0·113 |
| Carbonate of magnesia | 3·092 |
| Chloride of sodium | 61·102 |
| Chloride of magnesium | 30·252 |
| Bromide of magnesium | 0·875 |
| Silica | Traces |
| Organic matter | Traces |
| Total solids | 194·261 grains. |

And 5·322 cubic inches of carbonic acid gas.

This, it will be seen, is a sulphated saline water. Its effects, when taken internally, are, first, an increase of appetite ; so that, in the neighbourhood of the place, it is called the appetizing water, and digestion is improved. It promotes the regular excretion of the bowels, and, in large doses, purges. Its effects in jaundice seem well attested. It increases the action of the kidneys, and has produced absorption and removal of the water in dropsies by this action. According to the statement of Liebig, it diminishes the quantity of uric acid excreted, and so may be useful in gout. This seems reasonable enough. It is needless to say that a prodigious number of cures effected by the New Spa has been published. Nevertheless, there seems no reason to doubt that this water should hold a very high place among waters of its class as a saline alterative water. It would seem, from its composition, likely to act in a very similar manner to Cheltenham.

---

* L'Eau Amère de Frederickshall. Par le Docteur Eisenmann. Wurzburg, 1855.

The water may, like others of its class, be administered in two ways :—If constipation is to be removed, or there is dangerous cerebral congestion, for example, then it must be given in large doses, as a pint daily, or even three or four tumblers in the twenty-four hours. In chronic diseases, where it is wished to act by way of absorption, as has already been said in speaking of other saline waters, on the glands and kidneys, then it must be given in small doses, frequently repeated, as a wineglassful or two at a time. There are no precautions requisite in its use.

I cannot but express a very high opinion of the merits of this water, especially in the cure of those who wish to use a water at a distance.

The water of Salzbrunn, in Silesia, is an alkaline saline water, which, in the neighbourhood, has a reputation for curing phthisis.

# CHAPTER XV.

## MINERAL WATERS OF SWITZERLAND, SAVOY, AND OTHER COUNTRIES.

Here are the Alpine landscapes, which create
A fund for contemplation. To admire
Is a brief feeling, of a trivial date,
But something worthier do such scenes inspire.

Attractive characters of the countries.—Precautions suggested by the climate.—Phthisis.—Aix in Savoy; its distinguishing character.—The extent to which the Douche system is carried.—Elegance of the Casino. —Beauty of the environs.—St. Gervais a valuable sulphuretted saline water.—Retired character of the place.—Properties of the waters.—Evian a sanatorium like Malvern.—Waters not medicinal. —Savoy.—Saxon.—Leuk.—Immense quantity of the waters.—Extraordinary nature of the system of bathing.—Its powerful effects.—The Poussée.—Scenery around Leuk.—Weissemburg.—Pfeffers.—Road to Pfeffers.—Natural bridge.—The Tamina.—The water of Pfeffers.—Its composition.—The baths.—Diseases cured by them.—(Swiss) Baden.—Schinznach.—Its waters.—Their effects.—Other waters.—Penticosa.—Italian waters.

FEW countries can possess in greater perfection those adjuncts which are of so much importance in the administration of mineral waters than the beautiful regions in the vicinity of the Alps. The lakes, glaciers, and mountains all tend to please the eye, and withdraw the mind from disagreeable objects and former scenes of pain and anxiety, whether of a bodily or mental nature, while the mountain air raises the spirits and excites the mind to indulge in active recreation and exercise. The increased expansion of the chest gives vigour to the frame, and sends the blood, like a very spirit of life, dancing through the system. On the other hand, we must remember that those whose frames are not capable of such renovation, whose vital energies are worn out, may be damaged by the very circumstances that would be beneficial to others. Sudden transitions of climate, frequent alternations of temperature, exposure—sometimes in spite of every precaution—to rough weather, must be dangerous to some invalids, and especially those who labour under extensive organic disease. Where the vital organs are thoroughly diseased, rest seems the great thing, and it may be predicated with regard to many such that the wards of an hospital—certainly a quiet home—may be a more suitable residence than the vale of Chamouni. Perhaps there are few points in which a physician may be more called on to exercise tact, than in separating the cases where travel and residence, especially in mountain regions, may be beneficial, from others in which they may be injurious. Many of the hottest springs and most potent mineral waters rise in the most elevated, and, during a great part of the year, coldest mountain regions. This holds good from the Himalayas to the Pyrénées and the Andes. Consequently invalids are exceedingly likely to be sent to such regions. Great benefit, then, may often ensue from such migrations, when judiciously undertaken; and equally miserable effects. Consumptive patients are especially of that class. A physician should be well aware of what he is about, when it is a question of sending a phthisical patient to Ems or Cauterets.

In Switzerland there are no railways of any consequence, although the confines of the country can be easily reached in one direction from Basle, and in another from Munich to Zurich, and in a third from Lyons; and the invalid must have recourse to rather rough modes of conveyance in many cases.

The first of the spas to be described is one of great merit and beauty, the Savoyard Aix.

### AIX (SAVOY),

Is situated three leagues from Chambery, in a beautiful country. As usual, the Romans were not insensible to the merits of Aix, and remains of their baths are to be found.

N. Remond impr. r Vieille Estrapade 15 Paris. Dessiné et Gravé par E. Wormser

AIX EN SAVOIE

There are two principal springs at Aix, called respectively the Sulphur and the Alum. They spring near each other, and produce a prodigious quantity of water, so much that, besides supplying the baths, they supply the public fountains. The one is called the Sulphur-fountain, the other the Alum, although it does not contain a perceptible particle of that substance.* The water of these spas is beautifully clear, and exhales an odour of rotten eggs, which is better marked in the Sulphur. The taste, too, is nauseous, and the water causes eructations. The temperature is 113°, or a degree or two higher. They contain 3·683 grains of fixed principles in the pint, and very little sulphur, with two per cent. of their bulk of carbonic acid. They possess in this small quantity of solids traces of very many substances, as alum, strontia, and glairine. At some distance from the springs is a chalybeate. It will be seen that these waters are but feeble agents in a chemical point of view, but then they have their temperature.

There are two great establishments at Aix, one called the Royal or Grand Establishment, supplied by both the sources; the other, called Thermes Berthollet (for that great chemist was a Savoyard), supplied by the Alum. The Royal Establishment is very complete. There are private baths, but most patients prefer the common baths. These are very large, and used as swimming-baths. They are kept at a temperature of from 89° to 95°. They are lighted from the top. The vaporarium is a domed building, covered with glass, ten or sixteen feet in diameter, with little closets forming isolated stoves around it. There are two modes of administering the vapour: one consists in putting the head alone into it, the other in directing it, by means of pipes, on the affected part of the body.

The distinguishing characteristic of Aix is the mode in which the douches are used. These are of all kinds and temperatures. They are vertical, ascending, or oblique, hot, cold, and shower-baths alternately hot and cold. As to the quantity of water and force of the shock, all possible shades and varieties may be obtained. The douchers move the body in all directions, in fact, shampoo it. After this and the douching process, the usual practice is to administer a hot bath. There are stoves called the division of Hell, because there is a female and a male Hell. Here the water is forced on the floor of a subterranean apartment from different directions, and so clouds of vapour are raised, into which the patient is plunged. Here also the douche is applied while the feet are in the thermal water. The Royal Establishment baths are supplied from three stopcocks: one supplies the Sulphur water, one the natural water, and another the Alum.

---

* *i. e.* not perceptible to the senses.

The Thermes Berthollet is peculiar in its arrangement. It is composed of three principal divisions:—First, a vast vaulted apartment destined to douches and gratuitous stoves; second, an apartment above the preceding, reserved for local douches of steam; and, third, a large basin, once a *naumachia*, where the youth of Aix exercised themselves, and which served as a swimming school. Now, this basin is divided into several compartments, in some of which baths are given to the poor and the hospital patients, while others are reserved for veterinary purposes.

The waters are chiefly used externally, very little drunk; indeed it may be certain, from the perfection to which their external use is carried, that it is chiefly trusted to. After what has been said of many hot baths, there can be little doubt as to the results of such a system. It must powerfully stimulate the skin, and if persevered in is likely to produce effects of no mean power. As the practice is at many places where thermal waters are much used, and systematically, as we shall shortly see is the custom at Leuk, after the bath the patient is put to bed. The water at Aix is nearly of the temperature of our Bath, and of course can be employed at that point.

The diseases in which the waters are used are very much those in which we always find hot baths employed, as gout, especially when attended with tumefaction of the joints; cases, too, of general debility. There is a handsome casino,—no longer kursaal, at Aix, and the environs are exceedingly picturesque.

### SAINT GERVAIS (SAVOY).

The tale of the discovery of these waters has been told in my first chapter.* They are in the valley of the Arve, not far from the road to Chamouni, and their situation must be familiar to many travellers. The baths are beautifully situated in a romantic gorge, at some distance from the village of Saint Gervais, and at the foot of Mont Blanc. The place is, as it were, completely removed from the world. It consists of a single house, which is a true sanatorium or hospital, containing no less than 120 beds; as there is no other place of accommodation sufficiently near, the building is rather neat; behind it is the cataract of the Bonnant, and below a smiling valley, which, where the hospital is placed, is so narrow that the building occupies its entire breadth; shrubs and gardens are placed here and there, and walks are around, which in that mountain air must conduce to the health of the invalid.† There are four springs, three of which arise from a cave or gallery in the most retired part of the garden, and another which springs at the foot of the cataract.

The water is quite limpid, colourless, unctuous to the touch, and with a slightly bitter taste and styptic *arrière goût,* which Dr. James pronounces rather disagreeable. It has a distinct taste of sulphuretted hydrogen, and deposits in the channels in which it runs both sulphur and baregine. The temperature of the water is about 104°, or a little higher.* It contains 43·817 grains of solids in the pint, which are chiefly carbonate and sulphate of lime, many other salts of but little importance, and a minute quantity of iron; it also contains of sulphuret of calcium in the spring of the torrent 0·195 of a grain in the pint, about two-tenths of a grain, and much less than that of sulphuretted hydrogen. The waters of Saint Gervais, therefore, are very like some of the Pyrenean waters, feebly sulphurous, containing few salts, but thermal. It might not, therefore, to some one whose circumstances might oppose a visit to the Pyrenean mountains, be inexpedient to visit Saint Gervais; there may be different ideas about the place, but if the baths suited me I should not dislike a residence at Saint Gervais. Sallenches is only two leagues off, and there is easy access to Geneva at a distance of seven leagues. There is Chamouni and the Arve.

---

* The other story is, that a man who was fishing for trout in the torrent which runs past the place observed that the water was hot. Search was made, and the springs were found.

† Sir John Forbes says the position of the bath-house is beautifully picturesque; but it is much too confined, both in its air and its walks, to afford a desirable residence to an invalid. I visited the place in 1834.

The waters are somewhat laxative, are less stimulating than the purely sulphurous waters; they are also alterative, for the quantity of solids in a pint of sulphurous thermal water is not to be despised. They are used chiefly in obstinate skin affections, in enlargements of the abdomen, and in promoting a healthy state of the uterine organs. According to a local physician, Dr. Payen, they are very useful in latent rheumatism, when it affects the internal organs, in bringing it out externally. This seems very likely; they have also procured the expulsion of worms, and proved very useful in habitual constipation of sedentary females.

### EVIAN (SAVOY).

This is a water quite of a Malvern type, in one of the most charming sites in the world, and with as little claim to the rank of a spa. The place is a little town opposite Lausanne, *i. e.*, on the Savoy side of the beautiful Lake of Geneva. The water springs in the middle of the town, and supplies baths and two buvettes; it has neither taste nor smell; has a temperature of 53°, and precisely resembles ordinary spring water, which no doubt it is, and one of great purity too. It contains three or four grains of carbonates of soda, lime, and magnesia in the pint. It is perfectly absurd to read the way in which it is spoken of. We are told that the habitual dose is from seven to eight glasses, but that persons have been known to drink fifteen or twenty in the day without being the worse for it. No doubt; and much good may it do them. It is said to allay irritability, and produce diuretic effects; for such a quantity of cold water will act in that manner. It is employed with success in douches and baths. About a mile from it, and on the side of the Lake, is a weak chalybeate, where is a splendid kursaal, made from a pleasure-house of the Princes of Savoy, and where invalids are lodged; and I can speak from experience that a more salubrious locality they are not likely to find, but the only advantages they can expect to derive are those to be got from pure air and pure water.*

---

* There is some difference of statement as to the temperature. Professor Forbes, of Edinburgh, makes it 104°–106°.

## LAVEZ (SWITZERLAND),

Is a bathing-place in the Canton de Vaud, on the Rhone, and near the fall of the Pisse Vache. It is a slightly sulphurous but thermal water, having a temperature at its issue, it is said, of 107°. Having to traverse pipes, it loses part of its heat and its sulphur in the passage, and has hardly any sulphur in the baths; but at Bex there are salt-works, and the mother-water is added to the baths, so as to give them the mineral power which otherwise they would want,—a very happy idea, and which makes the baths very likely to be useful in all those scrofulous diseases in which saline baths are employed with so much advantage.

Further up the valley of the Rhone, along the road of the Simplon, we come to the waters of Saxon; these are slightly thermal, about the temperature of the waters of Malvern. They are saline waters, and no quantitative analysis of them had been lately given, except as far as bromine and iodine are concerned, from which it appears that they contain a rather unusual quantity of bromine and iodine; if so, they could not be in a better site, for amid these most beautiful scenes of nature is the abode of those miserable wretches the cretins, and the prevalence of goitre; and it is chiefly in scrofulous affections that merit is claimed for these waters.

---

* The author was partially educated at Geneva, and as a youth, twenty-five years ago, knapsack on back, and Alpine stick in hand, visited these localities, little dreaming of things to come, or a career including hospital experience in the East.

### LEUKEN (LOECHE) SWITZERLAND.

These baths are very different, as regards their character, from some others. The place, at the foot of the Gemmi, is composed both of wretched cottages, and splendid hotels for the visitors to the baths. These hotels can, many of them, accommodate one hundred visitors. Formerly the approach to Leuk was very difficult; now good roads have been made, and there is no difficulty. The waters of Leuk are very numerous (above twenty), and exceedingly plentiful in their supply. Indeed, much of the water is allowed to run to waste. The most abundant source is that called St. Laurent, or Lorenzquelle in German. Its temperature is 124°. The others vary from 95° to 99°. The waters are all of the same composition. In 1000 parts they contain 2·025 of solid principles. Of these 1·635 are sulphate of lime, 0·215 sulphate of magnesia, and 0·65 sulphate of potass, besides other principles. In chemical composition, in temperature, and in every particular, including the abundance, they bear a close resemblance, as Sir John Forbes has remarked, to Bath. There are eighteen or twenty large public baths, capable of holding some thirty people. Others hold a fewer number.

These baths were lately utilized in five principal establishments. The New Bath, or Bain Werrsa, the Bath of the Promenade, the Bath of the Zurichers, and the Hotel of the Alps. These are all fed by the spring Saint Laurent, except the Bain of the Alps. The baths are about a yard deep.

There is generally four common baths in one, yet separated by partitions, which prevent the water of one flowing to the other. A kind of gallery which passes along permits the visitors to talk to those in the baths. The baths are covered with roofs which show very rough carpentry. These strange things look by no means cleanly.

As these waters are in many instances too hot for use, the piscinæ are filled in the evening, and the water left to cool during the night, by which defective method the water loses nearly all its gas. But, in point of fact, it does not contain much gas, nor is there anything, to hands, eyes, or tongue, to distinguish it from ordinary hot water. The practice is to enter the bath early in the morning, clothed in a long linen tunic, to remain in it from two to four or five hours, and in the afternoon to repeat the practice for a shorter period. Each bather is provided with a floating table, on which anything the bather wants is placed: perhaps something to eat or drink; there they sit, talk, or read. After the bath the patient is put to bed. A season generally continues twenty-five days, for which the bather pays a Napoleon. It would be extraordinary, indeed, as Sir J. Forbes remarks, if such a practice did not produce some extraordinary effect. Its physiological effects are a cutaneous eruption, called the poussée. This comes on generally about the twelfth or sixteenth day. The preceding disorder may be slight, but is almost always manifested by febrile symptoms, more or less distinct, and by sediments in the urine. The tongue is loaded, and the appetite diminished, with a general feeling of disquietude. At this period an emetic often effects good. Then a vivid redness comes on, with prickling sensations of heat; and this redness appears especially at the knees and elbows; then it proceeds along the track of the muscles, the arms, belly, chest, and back, but it spares the hands and face. This redness is generally followed by a true eruption, and as this comes out, the febrile symptoms disappear. This eruption is formed of red spots, which disappear on pressure by the finger, and closely resemble erythema, or erysipelas; when it resembles most erysipelas the patients complain that the pain changes its character, and becomes sharp and biting. The skin in these places is often dry, sometimes covered with a kind of slimy perspiration.

Sometimes the eruption is distinctly vesicular, with a red base, which in twenty-four hours produces a white spot at its top, when this bursts and discharges a purulent fluid, which escapes and forms scales. Sometimes they are pustules. In fact, the eruption differs in different individuals. Exceptions occur. The result of the whole is, that there can be little doubt of the mode in which this bath cure operates. Here is a powerful system of counter-irritation, so powerful that sometimes the skin swells enormously, cracks, and an acrid, burning, and corroding fluid exudes, and causes cruel sufferings, especially during the sleepless nights which the patient is compelled to endure.

As the poussée disappears, desquamation comes on just as after skin diseases; the cuticle at least peels off as after scarlet fever. The power of skin diseases to relieve the affections of internal organs has long been known. I never knew a person marked with the small-pox to have consumption, and in the excellent work of MM. Barthez and Rodier on the Diseases of Children, it has been attempted to show by statistics that vaccination, however beneficial in other respects, increases the liability to consumption. The poussée, however, does not depend entirely on the counter-irritation of the water, since it has sometimes made its appearance in persons who merely drank the waters.

The extent to which this poussée goes appears to be peculiar to Leuk. Nowhere else, perhaps, is the practice of continuing such a lengthened period in the bath carried so far.

What are the diseases in which the waters of Leuk have been recommended?

In the first place, in lymphatic and scrofulous individuals they produce a powerful derivation towards the skin. How they act in cases of old wounds is not so explicable. In certain enlargements, where the viscera are concerned, their action is explicable enough, also in chronic gout and rheumatism. In the acute forms of this disease they would be injurious. In the class of calculous affections they could do good. It must be remembered that the winter of Leuk lasts from May till November, and that it is more than 4500 feet above the level of the sea.

To speak of the scenery around Leuk is almost superfluous, or the excursions that can be made in the neighbourhood. Is the visitor not placed in the centre of the mountain scenery of Switzerland? Never shall I forget the view from the Forclas of the valley of the Rhone, the Gemmi in the distance, and the mass of mountains, of all shapes and hues, piled one upon another; the aiguilles, like minarets of snow, shooting into the blue air; and the domed, snow-covered mountains, like the cupolas of mosques; the valley of the Rhone at the bottom, flat as possible, with its rich cultivation; the windings of the river; Martigny, with its tower and the rock of Sion; the straight line of the Simplon road; and then the rocky foreground and brawling brook. Nothing can be finer than that view—although it cannot surpass what I had then beheld, and have twice again surveyed, the Straits of Gibraltar, or the view of Africa and Europe from the signal-post, and the long line of the Sierras of Grenada, the Atlantic on the one hand and the Mediterranean on the other, with the stern, gloomy ridges of Atlas before us—or the view from Bourgolu, above Scutari, looking on one hand upon the Bosphorus, "the ocean stream studded with palaces," on the golden domes, and minarets, and cypress groves, or turning towards the Gulf of Nicomedia, and surveying Olympus "high and hoar," or round and casting the eye from the palaced borders and rich gardens of the Bosphorus, survey the desert plains and frowning mountains of Asia, from which civilization has passed away; or looking from the heights above Roumeli

Kawak, and down on the blue Symplegades, and over to the Giant's Mountain, just when the *Marengo*, before a fine wind, came through the Boghaz from the Black Sea, and saluted the Turkish Admiral's squadron lying in the Strait. But where all is so admirable, why make exceptions? Nothing has appeared to me more irrational than to give the preference to one kind of fine scenery over another where all is so beautiful. I have stood on the top of Cheviot with one who had been in every country of Europe, and far in the deserts of Africa, and had been upon Mount Sinai, and we both thought the fine panorama of green hills which surrounded us, with their lonely valleys, and the shades of the cloudy sky drifting over their multitudinous masses of glen and swelling hills, almost unsurpassed.

### WEISSEMBERG (SWITZERLAND).

Attention has of late been attracted to these waters from an account of the cures they have recently performed in cases of chest disease. They are situated in the south part of the Canton of Bern, about fourteen miles from Thun, in a deep valley, surrounded by steep fir-covered rocks. The water has a temperature of 84°, as nearly as possible that of our Buxton. It contains about 14·22 grains of fixed principles in the pint, of which the greater part is sulphate of lime.* It contains, besides, traces of silica, lithia, iodine, and iron. In composition it very much resembles Bath. These waters, however, although with the degree of thermality mentioned, are almost entirely employed in drink. They diminish the excitement of the pulse and heat of the skin. In short, according to the Italian idea of contra-stimulation, that is to say, of a direct sedative effect upon disease, they may be said to act in that way, and accordingly are supposed to be beneficial in pulmonary phthisis, and all kinds of bronchial catarrhs. There is some purgative effect exerted.

---

* The waters have other saline ingredients, sulphates of magnesia, soda, and carbonate of lime.

### PFEFFERS.

This is another of the great spas. There are two ways in which Pfeffers is most likely to be reached, from Zurich, by the Lake of Wallenstadt, or from St. Gothard and Coire coming in the direction of Italy. The road either way leads to Ragatz, where there is a splendid hotel, from which the distance is only about a league to the baths of Pfeffers. In order to reach them, you pass along the valley of the Tamina, a wild torrent which rushes to join the Rhine. Ragatz is in the Canton of Saint Gall, in the Grisons. The thermal water of Pfeffers is sufficient in quantity to be led down the glen of the Tamina by wooden pipes to the hotel of Ragatz. The road to the baths leads along this foaming torrent, which passes through Ragatz, on its way to the Rhine. The road along the margin of the narrow valley is in great part hewn in the rock. After passing the torrent over a wooden bridge, you enter a gate, the key to which is in the possession of the gate-keeper, and the ravine before you is one of the most remarkable kind. It is a narrow passage between two immense granitic mountains; the road is necessarily confined to the close proximity of the bed of the Tamina, which tumbles and roars over its rocky bottom. Occasionally the road is even dangerous, when the passage is over wooden planks rendered slippery by the foam of the stream, which thunders and rages in the depth below. In the middle of the road from Ragatz the rocks from each side form a kind of semicircle or arch, from bottom to top, leaving each other from the narrow bed of their origin to meet at the top, through which a little sunshine penetrates. This is the natural bridge of Pfeffers. Perhaps at some remote period the rocks had joined at top, like the natural bridges in America and elsewhere.

Immense blocks of stone lie in the bed of the Tamina, and others threaten to fall; never, certainly, was the approach to a spa by such an extraordinary path. Surely it might be concluded that unless the waters at such a spot possessed real virtues, patients would not be led for ages to go to the very wildest and most secluded spots in nature to seek for health. The road, after passing the Grotto of Saint Madeleine, to which legends are attached, arrives at last before the bathing establishment. Here there is no further progress, as there is only a kind of fissure in the rock left; in front of this the house is planted, certainly the most remarkable bathing establishment in the world.

There is almost always a legend about the discovery of these watering-places, like the stories about the discovery of Toeplitz, Karlsbad, and Saint Gervais. A young man, it is said, who in the eleventh century was in search of ravens that built their nests among the cliffs, discovered these hot springs; they were only used in the middle of the thirteenth century, when some wooden houses were erected for the accommodation of bathers. The first bathers were let down from the cliff above.* There was no building on the spot until the year 1630, when one was erected by the Abbot of Pfeffers, and the present place in 1704 by his successors. The property belongs now to the government of the Canton of St. Gall.

In former times people rested in the baths,—they slept there even as well as ate there, which is more than is ventured on at the baths of Leuk—and, the cure effected, were once more hoisted up as before, and restored to the upper world.

These facts are not trivial—not merely interesting historically, but they have a great and important bearing upon the whole subject of the theory of mineral waters. Pretty much in the same way, indeed, as those connected with Buxton do. The salts in Pfeffers, as in Buxton, do not exceed those in normal spring-water, barely three grains in the pint, of salts, of which the chief is carbonate of lime; nor do they differ in other respects, and there is no other ingredient to account for the action of the water, yet so it is that patients have always flocked with trust and confidence to this supposed source of health.

---

* Steps were used; but those who were too giddy to descend these were let down, tied in chairs, with bandaged eyes, from the heights above. How strong must have been the faith of an invalid who could undergo such treatment to descend into a kind of pit almost, in search of health!

The house is built in the form of an amphitheatre, on account of the want of space about the spot; it is dull and gloomy-looking, and very strongly built; altogether it wears a monastic aspect, and partakes of the character of the locality. In the interior are large corridors, upon which the apartments of the patients enter; these are sufficiently comfortably furnished; the dining-room is the ancient refectory of the monks, and some of the portraits of their abbots hang there.

There are private and common baths; the baths are clean, and supplied with a constant stream always of the same temperature—99·85°, close upon 100°. When the waters reach Ragatz they have lost some degrees of heat. There are also public baths. Three springs constitute the waters of Pfeffers, but only one, called the Chaudière, the most abundant, is much in use. There are douches in the establishment.

The waters are drunk pretty commonly, as well as used for baths. It is certainly a remarkable thing in regard to these natural springs, that while ordinary hot water is drunk with a feeling of disgust, and often provokes sickness, and certainly does not improve the appetite, these natural thermal waters are relished, raise the spirits, and improve the appetite.

The practice of bathing during entire days at Pfeffers is abandoned. It is seldom that at Pfeffers they are employed for more than an hour or two. The poussée is rarely seen here, as at Leuk. Two baths are generally taken daily.

The baths at Pfeffers are supposed to be especially beneficial in nervous cases, to be calmative and vivifying. The cases which come there are very much of the nervous kind; there is, however, often some little fever caused, accompanied with sediments in the urinary discharge, but these quickly pass away. A great many of the patients who come to Pfeffers are hysterical cases, and what are called nervous cases, but there are also a good many of more serious affections of the nervous system, rheumatic neuralgia, diseases of the brain or spinal cord threatening softening, at an early stage, affections of the stomach of a nervous character, and so forth.

Notwithstanding the favourable opinion so widely entertained of the powers of Pfeffers, two at least of our most eminent English physicians have ventured to express their doubts, to use a mild term. Dr. James Johnson, in his round way, ventures to deny that there is anything in the water but what common water could accomplish; and Sir J. Forbes expresses himself so on the subject that I must quote his very words :—

"Considering the nature of the mineral impregnations of this water, and the manner in which it is here used, and considering the nature of the locality and the circumstances under which it is used, it is impossible to believe, without very strong evidence, that a residence at Bad Pfeffers can be of material use in most chronic cases. In the case of nervous invalids, a considerable number of whom are found among the patients, I cannot but think that injury, not benefit, must be derived from a residence here. The close, confined atmosphere of the whole ravine, out of doors, with no means of escaping from it by paths which an invalid could climb, the hot and damp air of the house within, with its low roofs and dark galleries, must surely aggravate all sorts of nervous affections. It seems nevertheless possible, that these baths may still retain their fame even in these cases, on the authority of a dogma very prevalent at watering-places, and not unknown to the practice of medicine generally, namely, that though not benefited at the time when the course of treatment is in progress, they will be so after it is over. I think I could venture to predict that most of the nervous patients of my colleague, the Bad Arzt, at Bad Pfeffers, will find themselves better after they have left it; whether they may find themselves better than before they came to it, I will not so confidently assert."*

The doctrine of the absolute weakness of mineral waters being in their favour, is again brought forward by Dr. James, in regard to Pfeffers. He says, that the weakness of the waters of Pfeffers renders them especially useful in urinary affections connected with irritability of the bladder, since they are freely absorbed, and serve to irrigate the passages; but surely in this case distilled water would have been better still, or a demulcent tisan? I still think that here the rule which I have laid down will turn out to be the true one, viz., that in all cases—except *where thermality is present*—as a general rule, the chemical composition of a water is a measure of its power.

Ragatz, being a place of very different attractions from Pfeffers, is much frequented by patients who wish to make use of the waters, which, as has been said, are conveyed the distance of a league in wooden pipes; but although there is only a loss of two or three degrees of temperature, the belief among the patients is that the effects are very different, in spite of the superiority of Ragatz in every other hygienic respect. It is the same as it has always been with regard to these thermal waters, there is a confidence on the part of the world at large which nothing can overcome.

## TARASP (SWITZERLAND),

Is situated on the banks of the Inn in the Grisons. This is a very gaseous water, containing a very considerable quantity of salts, happily arranged as regards their constitution. The water contains in a thousand parts:

| | |
|---|---|
| Chloride of sodium | 3·693 |
| Sulphate of soda | 2·263 |
| Bicarbonate of soda | 4·701 |
| Carbonate of lime | 1·602 |

As well as other salts of potass, lime and alumina, manganese, traces of bromine and iodine, and a considerable quantity of carbonic acid. These waters purge without debilitating, and act also as resolvent medicines. Then they are employed with success against abdominal plethora generally; but it appears to me that from its composition this water should take a very high character indeed. I do not see why it should not be found as useful in phthisical cases as even Ems or any other spa. Be it understood, cases of incipient phthisis are alone thought of.

---

* "A Physician's Holiday."

### BADEN (SWISS),

Situated four leagues from Zurich. Wherever the Romans established themselves they appear to have seized on the hot springs, and their terms have been changed into the vernacular—the French Bains, the German Baden, and the English Bath. It would be curious to inquire how far this excessive love of hot water in health and disease improved their constitutions. Their poet wrote—

> "Balnea, vina, Venus corrumpunt corpora nostra;"

and my own opinion is, that they were a short-lived race. I think that we must be struck with the early age of most of those whose deaths are recorded in Roman epitaphs found in Britain. This can be ascertained by any one who passes through the museums scattered through the country. Nor was it confined to the opulent and presumably luxurious citizen. The centurion is continually found bewailing his dear wife or daughter who departed at an early period. There is no good thing but what may be abused; and it has more than once occurred to me that this shortness of life, supposing it to be the case, and it would be well worth while collecting all the Roman epitaphs which exist to see whether the conjecture be well-founded, could be connected with this excessive fondness for hot baths. Certainly the hot bath is rather calculated to assist in removing the elements of disease, and in promoting simple cleanliness in health, than for increasing actual physical or constitutional health. However, be this as it may, in Switzerland, even as everywhere in the countries subject to their eagles, they never seem to have neglected to make use of a thermal source. At Baden, denominated Thermae Helveticae, the ruins, bronzes, and medals prove their presence.

The present city is built upon the site of the ancient one. The city is divided into two parts, an upper and a lower, and the springs are seated in the lower.

The waters come from many sources, from the lowest part of the gypseous basin which traverses the valley of Baden. The sources are very numerous, and each hotel has its own. The general temperature is high, about 122°.* The sources are limpid and colourless; and, received into a glass, allow some bubbles of gas to escape. The taste is sweet, with a salt and somewhat sulphurous *arrière goût.* These waters deposit sulphur in their basins, although hardly a trace of it can be found in the baths. It is the same thing as in the case of Aix-la-Chapelle—the quantity of the sulphur is so small that little of it can be detected.

The Baden waters seem, both by their constitution and their thermality, to be entitled to very considerable reputation among mineral thermal springs. They contain nearly forty grains of solids in the pint, according to the analysis of Loewig, chiefly alkaline and earthy sulphates and chlorides.

These waters increase the renal secretion, and improve the appetite, but they are apt to constipate, which property, no doubt, they owe to the chief salt they contain being the sulphate of lime.

These waters were once spoken of as very powerful remedies in gouty and rheumatic diseases, and no doubt they have the properties of their class. They resemble Bath, but from their thermal and chemical constitution ought to have more power. Their chief use at present is in bowel complaints, where there is great atony, and at the same time congestion of the parts concerned in the disease. In threatened pulmonary attacks, also, they are much resorted to. The object of the invalids is to inhale in the corridors and places appropriated to the douches and baths the atmosphere of sulphuretted hydrogen which escapes, and which is regarded as calmative. Many patients remain during the winter on account of the mildness of the climate. The environs are delightful, the place itself rather dull. In the Hotel de Ville of the town, in 1714, Prince Eugene and Marshal Villars negotiated the peace which put an end to the War of the Succession.

---

* Loewig makes the temperature higher. I quote another authority.

### BIRMENSTORF (SWITZERLAND).

Bitter purgative waters, which closely resemble the bitter wassers of Pullna and Saidschutz. They are cold waters, which arise at a short distance from Baden, and are chiefly used for exportation.

### SCHINZNACH (SWITZERLAND),

Is only a league or two from Baden, and they are connected by a very romantic route. The baths, like those of St. Gervais, are isolated from every other habitation, but there is no other resemblance. Instead of the steep and narrow gorge in which St. Gervais is cooped up, Schinznach is placed in a broad and fertile valley, in which flows the beautiful Arve, one of the finest rivers in Switzerland. The thermal establishment is on a magnificent scale. The buildings are large, with separate courts, connecting corridors, and wings; and there are, indeed, few establishments which surpass Schinznach in splendour. There is only one spring, which rises close to the banks of the river. In the cistern in which it rises there is a large deposit of sulphur, and a strong odour of sulphuretted hydrogen arises when this is uncovered. From this cistern the water is distributed by pumps to various parts of the establishment.

The water is clear and colourless. It has a temperature of 91·2°. It appears that this water is the most sulphurous of all the Continental waters. It may be so, for, as we have seen, these waters are for the most part possessed of very feeble doses of sulphur. Such a water as Harrowgate does not exist on the Continent. The advantage which, as has been more than once remarked, the Continental sulphur waters possess, is in their thermality. Unfortunately, however, the quantity of sulphur in this water is, to a great extent, conjectural, a precise analysis not having been made.

The baths are very roomy, and are ranged on each side of a corridor, whose extremities communicate with the apartments occupied by the patients, so that these can go directly to the bath without encountering the open air. As the water is naturally of no very high temperature, and loses something in its passage to the baths from the cistern in which it springs, it is heated a little for use.

The baths at first are not prolonged beyond fifteen or twenty minutes, but the duration is increased if the case seems to require it. Their effect is shown at first by acceleration of the pulse, increased colour of the face, and increase of the respiration, and great redness of the skin.

The skin becomes redder as the bathing proceeds from day to day. At first this redness quickly disappears on contact with the air, but it gradually becomes more permanent, until at last the congestion thus induced terminates in an eruption. At first circumscribed red patches appear; these unite, and finally the whole skin, except the hands and face, is one uniform red sheet. At this stage the skin is smooth, shining, and painful; but the redness gradually disappears, and a regular desquamation takes its place.

Here, then, we have an effect very analogous to that of Leuk produced by different means. But here the amount of desquamation is excessive in proportion to the irritation produced. In other words, the sulphur baths arrive more pleasantly at the result obtained so forcibly, and at so much sacrifice of time and physical endurance, at Leuk.

Taking all these things together—gas baths, mud baths, chlorine baths, carbonic acid baths, sulphur baths—what we may call forced bathing, as practised at Leuk, and, to a great extent, hydropathy, are all extraordinary means of obtaining the same end, viz., an abnormal irritation of the skin, which acts as a general counter-irritation, and so relieves an inflammatory or congested state of the internal organs.

The waters of Schinznach are drunk as well as used externally, but no amount of drinking will bring about this eruption—that is produced solely by the baths; but we have seen that it is not so at Harrowgate. There the poussée is produced by the internal as well as the external use of the waters. Indeed, at Harrowgate bathing is too little practised.

While the baths relieve internal organs, they also stimulate external parts devoid of sufficient vitality. Under their influence spongy ulcers become firm and contract, wounds cicatrize, and skin diseases disappear.

There is little need at Schinznach of other modes of treatment than the simple bath. It appears to be so powerful, from the large dose of sulphur that the water contains, as to require no other aid. What a pity that we want analyses of this apparently most valuable sulphur water. Such analyses would throw much light upon the medicinal action of a pure sulphur thermal spring.

The situation is low, which does not prevent the place affording agreeable views. The environs are very agreeable; a fine wood close to the place skirts the Arve; close, too, are the ruins of the Castle of Hapsburgh, the original seat of the House of Austria.

Wildegg is a saline spring close to Schinznach, and employed along with it internally. The use of a saline tonic and alterative internally along with sulphur baths is a mode of treatment peculiarly likely to be beneficial in scrofulous diseases.

## OTHER FOREIGN WATERS.

The invalid is little likely to go beyond the bounds of France, Belgium, Germany, Savoy, and Switzerland in search of a watering-place. Nevertheless, there are some other springs which merit notice either as being within reach, or from their singularity. Thus there is the remarkable Spanish watering-place of Penticosa, situated at a level of 8500 feet above the sea.

Penticosa is placed in a green basin of the Pyrénées at this stupendous elevation; it is, in fact, in one of these little green hollows which sometimes occur amid the highest and most rugged mountain peaks. There is a little lake in the hollow. The place is fifty-six miles from Pau, and is a favourite excursion for some of the more adventurous residents at the French watering-places.

There are three principal springs, called Sources of the Liver, Skin Diseases, and Stomach—a novel mode of designating mineral springs; but we are now in Spain, which apparently differs much from the rest of the world. The two first of these springs are saline, the other sulphurous. The spring most in use is the Liver; it has a temperature of 79°, is without taste or smell, and but very weak in salts. Received in a glass, it is at first quite clear, then becomes troubled, sparkles, numerous bubbles are disengaged, which burst upon the surface. These are said to be pure azote. I quote this fact purposely, because it may seem to contradict the views I have expressed elsewhere (see Buxton) with regard to the medicinal action of azote. According to the statement at the place, sixty medicinal pounds contain 1066 cubic inches of the gas. Another account (Francis on Climate) represents the matter in a different light, and more in accordance with the views I have elsewhere expressed. "Owing to the large quantity of azote which it contains, larger than that of any known spring, except Saratoga, in America, numerous bubbles of gas escape *with* the water, *especially in times of tempest;* they cover also the sides of the glass into which the water is poured." (p. 291.) This spring is chiefly employed in chest affections; its action is said to be sedative. In commencing phthisis and in hæmoptysis there are great accounts of benefits derived from it.

It is well supported by the stomach; it increases the action of the kidneys, and usually of the skin; languor and indisposition for exertion succeed, and last for a short time; the cough becomes softer and less frequent, expectoration is facilitated, the appetite restored, and a notable increase of strength occurs. The fame of this spring in chest affections is very great.

The "Skin" spring resembles the other, has the same temperature, but is not gaseous. The "Stomach" source is a feebly sulphuretted water.

## Italian Waters.

Piedmont possesses a powerful thermal spring in Acqui, which is a fine town, situated six leagues from Alessandria, and ten from Genoa. The waters of Acqui are sulphurous, and very numerous; some being cold, others thermal. The hottest has a temperature of no less than 167°. It is quite limpid, has a saline and feebly sulphurous taste. Like the waters at Chaudes Aigues, as the supply is great, the water is applied to many domestic purposes, and effects a great saving of fuel. In order that its flavour may not be communicated to anything cooked in it, it is sufficient to mix it with half its bulk of common water, which is a proof of its want of activity.

But the great merit of Acqui arises not from its baths of water, but of mud applied to external affections, skin diseases, and ulcers. This is a sort of humus which is mixed with the waters of the hot springs, and heated by them, and applied to the affected part. There is a splendid establishment for the use of these. The patient is placed in a bath, and not buried in the mud, as elsewhere, and the application used as a plaster as hot as can be supported: the result is the exhalation of steam, which converts the application into a kind of local vapour-bath. The activity of the circulation of the affected part is increased; in fact, it is a local stimulation. In indolent ulcers, tumours, swelling of joints, etc., very good results are thus obtained.

### LUCCA.

The baths of this name are fifteen miles from the town of Lucca, on the slope of a hill called Corsena. They are delightfully situated amid vine-covered hills.

There are six thermal establishments scattered on the slope of the hill which furnishes this water. One of these was founded by Prince Demidoff for the poor. The temperature of the springs varies from 88° to 132°. They contain a moderate quantity of salts. They hold in suspension a red matter, which is the silicate of iron, and which is found especially in one spring. The waters are limpid and inodorous, with a slightly saline taste. They have the reputation of being calmative. They are used in nervous cases, and with great success in rheumatic affections where there is much susceptibility of the skin, also in abdominal tumours, and in leucorrhœa and other female complaints. The fineness of the climate renders the baths at Lucca a most agreeable residence.

### MONTE CATINI.

These waters are situated between Lucca and Pistoia, in the valley of the Nievola. The place is said to be named after Catiline, who is supposed to have encamped here previous to his defeat at Picenum. The waters are of the saline class. Their composition is very similar to that of sea-water. They have a temperature of from 68° to 86°. According to their strength they may be classed as Leopold, Tretta, Bagno Regio Tettuccio, and Source of Médicis. The chloride of sodium is in excess, then come the sulphates and carbonates, lime and magnesia. The water contains also iodine. The water of the sources is clear and transparent.

The waters are laxative and alterative. In diseases of the liver they are considered especially beneficial. Old Indians, residing in Tuscany, might use the waters of Monte Catini with benefit.

As might be supposed from their volcanic character, the geological formations in the Neapolitan States yield several waters highly charged with salts and gas. But the subject of particular Continental waters has already been extended as far as the limits of this work will permit. It would be highly interesting to extend the subject, so as to include in one particular work the natural history of all the mineral waters known ; and it would be worthy of a Government to make such a work national—to employ a commission to carry it out, and institute analyses where such were required.

# PART IV.

## MINERAL WATERS OF SCOTLAND AND IRELAND.

I REGRET to have so little to say about the mineral waters of these countries. Scotland does indeed possess some valuable springs, and in all probability, if the matter were fully investigated, it would be found that she has more. It is surprising that in a country abounding in scientific men, so little has been done to institute a thorough examination into the mineral waters. Such an inquiry, however, it is understood, is about to be instituted. A prize has been offered by a society in Edinburgh, which it is hoped will lead to a thorough investigation into the subject. The many picturesque and beautiful scenes of Scotland, associated as they are often with the most interesting historical events, and illustrated by the muse of her sons of genius, would derive additional value from being connected with the sites of mineral waters; and there is no country in the world which in this way could yield the *adjuvantia* which contribute so much to the good effects of mineral waters in greater perfection.

With regard to the mineral waters of Ireland, they are almost a blank. What is known about them is fully before us, however, for a work has been published with the title of "The Irish Watering Places, their Climate, Scenery, and Accommodations, including Analyses of the Principal Springs by Dr. R. Kane; and Remarks on the various Forms of Disease to which they are adapted, together with Directions for the Regimen of Invalids, and Observations on Indigestion, Gout, Pulmonary Consumption, and other Diseases of the Chest, Stomach, and Nervous System." By Alex. Knox, M.D., etc. Dublin, 1845."

### MINERAL WATERS OF SCOTLAND.

Pitkeathly, near the Brig of Earn, in the county of Perth, holds perhaps the first rank among Scottish spas. There are two stories connected with its discovery. One is pretty much the one we are accustomed to, viz., that the neighbouring peasants were attracted to it by flocks of pigeons visiting the spot; another, that a reaper in a field near being thirsty, drank rather freely of it on a hot day, and experienced its effects. There is a curious minute concerning it in the book of kirk-session of the parish :—" 20th September, 1711. Session met according to appointment, and took into consideration the profanation of the Sabbath, by people frequenting the mineral waters of Pitkeathly; whereupon some of the elders were ordered to visit the well every Sabbath morning, and dehort the people from coming to it on the Lord's day, and inquire what parishes they belong to, that word may be sent to their respective parishes to discharge them, and John Vallance is forbidden to give them passage at Dunferry boat; and Thomas Drummond is desired to spread the report that they are to be stopped by constables, by authorities of justices of the peace." Was this last piece of fame that Thomas Drummond was desired to circulate a pious fraud?

Sixty years ago considerable consternation was created from the circumstance of the water being fouled by people washing diseased limbs in them. A building was erected, and baths provided.

Some observations have been published on this water by Dr. Edwards. He found that carbonic acid gas was disengaged when it was heated, also atmospheric air and nitrogen. In a wine gallon its contents were—

| | | |
|---|---|---|
| Carbonic acid gas | 9·5 | cubic inches. |
| Azote (nitrogen) | 1·5 | ,, ,, |
| Carbonate of lime | 5·7 | grains. |
| Chloride of calcium | 170·0 | ,, |
| Sulphate of soda | 6·3 | ,, |
| Chloride of sodium | 114·5 | ,, |
| | 307·5 | ,, |

The water is, therefore, a powerful saline spring; its operation is purgative and diuretic, and we cannot but think its long-continued use would produce alterative effects. The diseases in which Dr. Edwards recommends it are in plethora and tendency to apoplexy, and in abdominal tumours. In skin diseases also he thinks, although its external use would be anything but useful, internally it might do good. In scrofula he sees no good to be derived from it, since its chief constituent, the chloride of calcium, once much in vogue among medical men, has now deservedly fallen into disuse. Both with respect to the skin diseases and the scrofula, I should differ from Dr. Edwards. In irritable skin diseases undoubtedly baths of such a water might be injurious, but not in those arising from deficient action. As regards scrofula, chloride of calcium, along with chloride of barium, were recommended by the illustrious Hufeland; and if they have fallen into disuse, it is on account of the subsequent discovery of iodine; but mineral waters containing the chlorides have been recognised as remedies for scrofula at all times. When given as a purgative, the water should be used in as large doses as the stomach can bear; but as a diuretic in smaller doses, not exceeding at most a tumbler, frequently repeated. I am not aware of the doses in which it is given at the spa, but should judge this to be the case from the constitution of the water.

### DUMBLANE,

Also like its predecessor in Perthshire; was discovered in 1814. It very much resembles Pitkeathly.

In a pint it contains—

| | | |
|---|---|---|
| Chloride of sodium | 24·0 | grains. |
| Chloride of calcium | 18·00 | ,, |
| Sulphate of lime | 3·50 | ,, |
| Carbonate of lime | 0·50 | ,, |
| Oxide of iron | 0·17 | ,, |
| | 46·17 | ,, |

This water so closely resembles Pitkeathly in its general constitution, that any observations on its properties may be dispensed with.

### MOFFAT,

A clean and picturesquely-situated village in Dumfriesshire, is now easily accessible by rail. The station is Beatock on the Caledonian Railway, where there is (at least was when I visited Moffat spas), a clean, plain inn, where the charges were very moderate, and where I spent some days with great pleasure, enjoying the rural scenery, rambling among the wild mountains near the Grey Mare's Tail, and pulling the trouts out of the sparkling streams. From Beatock conveyance can be got to Moffat, where plain but comfortable lodgings can be easily procured. Moffat is a good deal sheltered from the north-east, open to the south-west, whence the breezes from the Solway, although they may bring rain, are soft and balmy compared with the ruder winds from the other directions, which must be effectually restrained by the stupendous mass of the Hartfell mountains.* Indeed, I believe Moffat is rather a favourite place with the Edinburgh physicians as a residence for those whose lungs are delicate.

Moffat possesses two spas:

1st.—The Hartfell Spring, which rises in a ravine of this gigantic mountain. By the redness of the surrounding stones, it is easy to see that a chalybeate is present. It is four miles from Moffat, which is a great drawback; but it is a water (one of those copperas waters I have spoken of) in its undiluted state quite unfit for use, although not so strong as Sandrock, and therefore it could be sent to the invalid. In a wine gallon its contents are—

---

* 3000 feet above the sea.

| | | |
|---|---|---|
| Azote | 5 | cubic inches. |
| Sulphate of iron | 84·0 | grains. |
| Sulphate of alumina | 12·0 | ,, |
| Oxide of iron | 0·15 | ,, |
| | 96·15 | solids. |

The quantity of iron, although not so great as at Sandrock, is inconveniently large, and its combination with alumina would render it astringent. As the proper dose of sulphate of iron should not exceed two grains, it follows that the fortieth part of a wine gallon would be the largest dose. No doubt it would have a tendency to congest the head; I can conceive that where there was a tendency to spitting of blood, or excessive hæmorrhages in other ways, it might be very beneficial. In phthisis, too, in the incipient form, a ride to Hartfell on a fine summer day, and a small quantity of this chalybeate, might probably serve a good end.*

Moffat Sulphur Well arises from a rock of shale, about a mile from Moffat. It is brought by pipes to a small bath-house close by, where a person attends to distribute it. The water when drawn sparkles in the glass, and small bubbles are disengaged; its taste is not disagreeable, although there is an unmistakeable *arrière goût* of sulphur. Its contents are, in the wine gallon—according to the analysis of the well-known Dr. Garnet, who analysed numerous waters about the beginning of the century, and was an excellent chemist for his day—

| | | |
|---|---|---|
| Azote | 4 | cubic inches. |
| Sulphuretted hydrogen | 10 | ,, ,, |

And the solid contents not more than 35 grains of chloride of sodium.

---

* It is a fact that this water is stronger after rain; such is sometimes but rarely, the case with mineral waters.

This, therefore, is a pure sulphuretted water, and very similar to Gilsland; it is diuretic, and acts upon the skin. Of course at the spot we are told of all the usual wonderful cases, but the fact is, that drunk in considerable quantity it would prove a mild alterative. It is taken in pipes to Moffat.

There are many attractions in the vicinity of Moffat. About twelve miles to the west is the Grey Mare's Tail, one of the finest cataracts in Scotland; the height of the fall is said to be three hundred feet, and a wilder or more terrific scene, especially when observed in solitude, can hardly be conceived. The source of the rivulet is a lonely mountain-lake or tarn, called Loch Skene, and is still frequented by the eagle for the lake contains great numbers of trout. A mound, called the "Giant's Grave," is at the mouth of the recess forming the cascade, as if for the defence of the pass. The whole is described in some fine lines in "Marmion"—

> "Through the rude barriers of the lake,
> Away the hurrying waters break;
> Faster and whiter dash and curl,
> Till down yon dark abyss they hurl;
> Then issuing forth one foaming wave,
> And wheeling round the giant's grave,
> White as the snowy charger's tail,
> Drive down the pass of Moffat dale."

Further on is the beautiful and solemn Lake of St. Mary's, surrounded by green hills, where all is solitary. Never was a better description of the whole scene than when Wordsworth applied to it the phrase "pastoral melancholy." The railway allows of an easy visit being made to the Lead hills. The southern tourist goes eternally to the Lakes or some other place of resort; such places as Moffat and the one I am next to describe offer very great attractions, and present the charm of comparative novelty.

### INVERLEITHEN,

In Peebles-shire, is placed just where the brook called the Leithen joins the Tweed. Is undoubtedly the St. Ronan's Well of Sir Walter Scott.

On a hill above the principal hotel two streams issue from a greywacke rock, and are received in a pump-room, where they are distributed. These streams are of different strength. According to the analysis of Dr. Fyfe, of Edinburgh, a lecturer on chemistry there, these waters contain in a quart—

| | | | |
|---|---|---|---|
| No. 1.— | Carbonate of magnesia | 5·3 | grains. |
| | Chloride of calcium | 9·5 | ,, |
| | Chloride of sodium | 21·2 | ,, |
| | Solids | 36·0 | ,, |
| No. 2.— | Carbonate of magnesia | 5·3 | ,, |
| | Chloride of calcium | 19·5 | ,, |
| | Chloride of sodium | 31·6 | ,, |
| | Solids | 56·4 | ,, |

These, therefore, are very weak waters, although No. 2 may have some power, but the place has considerable attractions from the beauty of the scenery, the purity of the atmosphere, and it offers great inducements to the angler, excellent fishing being to be had both in the Tweed and in the brook Leithen. There are two inns at the place, one an old inn, supposed to be that of Meg Dods, and the other a place of more pretensions—that which she indignantly denominated the "Hottle." Opposite Inverleithen, on the other side of the Tweed, is the clump of trees known in Scottish song as "the bush aboon Traquhair."

### AIRTHREY

Rises in the high ground above the Bridge of Allan, in Stirlingshire. It was discovered in the course of working the Airthrey copper mine, from the floor of which it springs. The miners, conceiving it to be common water, made use of it for some time for culinary purposes, which is extraordinary, considering its composition, and yet we cannot doubt the analyses which were made by no less a chemist than the late Dr. Thompson, of Glasgow.

There are four springs. It will only be necessary to give the composition of two of them, No. 1 and No. 3, No. 4 not being used. They rise in the mine, and are pumped to the surface, where a neat pump-room, with baths, was erected by Lord Abercromby.

Contents of No. 1, in a pint:—

| | | |
|---|---|---|
| Solids | 73·68 | grains. |
| Chloride of sodium | 37·45 | ,, |
| Chloride of calcium | 34·32 | ,, |
| Sulphate of lime | 1·19 | ,, |

Of No. 3 :—

| | | |
|---|---|---|
| Solids | 89·16 | ,, |
| Chloride of sodium | 47·534 | ,, |
| Chloride of calcium | 38·461 | ,, |
| Sulphate of lime | 4·715 | ,, |

These springs are clearly of an alterative character, and are much frequented, as the Bridge of Allan is a favourite place of resort. Five hundred people have been known to drink in one day. There is but indifferent accommodation in the place.

### STRATHPEFFER.

This is the most remarkable of the Scottish watering-places, and, indeed, in one respect perhaps in Britain, for it contains, according to the analysis of Dr. Thompson, the largest known quantity of sulphuretted hydrogen gas of any water. The springs are situated in the parish of Fodderty, in Ross-shire. There are many mineral springs. The strata consist of shale, mixed with sulphuret of iron. There are two wells at a short distance from each other. The temperature of the wells on the 24th of June, when Dr. Thompson examined them, was—the lower 39°, and the upper 39¼°. Day rainy; temperature of the air under 60°. Both had the smell of sulphuretted hydrogen. Specific gravity of Upper Well 1·0019, of Lower 1·0091. The contents were, in an imperial gallon. The Upper Well—

| | | | |
|---|---|---|---|
| | Sulphuretted hydrogen ...... | 26·167 | cubic inches. |
| Solids :— | Sulphate of soda ............... | 67·770 | grains. |
| | Sulphate of lime ............... | 39·454 | ,, |
| | Chloride of sodium ............ | 29·728 | ,, |
| | Sulphate of magnesia ......... | 6·242 | ,, |
| | | 143·194 | ,, |

Of the Lower Spring—

| | | | |
|---|---|---|---|
| | Sulphuretted hydrogen ...... | 13·639 | cubic inches. |
| Solids :— | Sulphate of soda ............... | 52·710 | grains. |
| | Sulphate of lime ............... | 30·686 | ,, |
| | Chloride of sodium ... ........ | 19·233 | ,, |
| | Sulphate of magnesia ......... | 4·855 | ,, |
| | | 107·384 | ,, |

These waters therefore, weaker than Harrowgate in salts, yet possess a most valuable saline constitution, a union of sulphates with chlorides having always been found extremely important; but they contain (the No. 1 Spring) by far the largest quantity of sulphuretted hydrogen yet discovered in Great Britain in any spa, and the other an average quantity, or rather above the average. In 1819 a handsome pump-room was erected. The waters are used in gout, rheumatism, scrofula, skin diseases, and the usual diseases in which sulphur waters are employed. In a publication concerning Strathpeffer an odd argument is used for one of its merits — "Its specific gravity approximates to the waters on the Rhine, from which circumstance large quantities can be drunk." There is a chalybeate near at hand, which is found useful after a cure has been effected by the powerful sulphuretted water. Of the power of these waters there can be no doubt. The middle classes of the north of Scotland flock in great numbers to this spa, which is by no means the rude place that many might suppose. There is excellent hotel accommodation. The place is seven miles or thereabouts from Dingwall. One thing marks the character of Strathpeffer—the poor as well as the rich endeavour to avail themselves of the healing fountain.

Near Edinburgh is a moderately-impregnated sulphur well, over which a handsome edifice has been erected in a rather romantic situation. It is astonishing how few of the citizens of Edinburgh frequent this place, just as the Londoners neglect Kilburn and Hampstead.

## WATERS OF IRELAND.

Dr. Knox states, in the commencement of his work, that the waters of Ireland are neglected, but after carefully perusing his work I am totally unable to find in it the proof of the existence of a single water entitled to be called mineral in the country, unless it be the slightly thermal spring of Mallow, or, strange to say, the waters used as drinks by the inhabitants of Limerick. After stating that Irish waters are generally the purest, he goes on—" A wine-pint of the waters of Limerick, according to Dr. Gore's analysis, contains the following portions of saline matters :—

| | Grains. |
|---|---|
| The well at the entrance-gate of the New Barrack ............ | 7·0 |
| Well at the hospital of ditto ....... ................................ | 7·8 |
| Force-pump well outside the wall of ditto ...................... | 5·0 |
| Drinking-well at the Ordnance Barracks ...... .................. | 6·4 |
| Well used for horses at ditto ......................................... ... | 22·5 |
| Water of the river Shannon, from the tanks of the Limerick Water Company ..................................................... | 2·5." |

So that even the river Shannon would be more mineralized that Buxton water. I have analysed the waters of the Tyne and Tees, and found about ten grains in the *imperial* gallon in the one, and only four in the other, although these waters carry with them a quantity of organic matter derived from the moors in which they have their origin. Of Lisdoonvarna Spa, we are told that it contains 2·19 of solids in the 10,000 grains, of which 0·28 are oxide of iron; and of

Kilkea Spa—" The extremely minute subdivision of the ingredients which are held in solution in the water causes it to be the more valuable as a remedy."—(p. 317.) And again (p. 50), " to the objection that these ingredients exist in quantities too small to allow of them being efficacious, we may reply that their effects on the secretions are obvious, and probably increased by the state of permanent and minute division in which they are applied." This is the old story, which I have so often exposed. Homœopathy undisguised is better than this. The fact is, that Dr. Knox, being unable to find a true mineral water in Ireland, is driven to this shift to conceal the nakedness of the land. But there must be true mineral springs in Ireland. Ballinahinch Well, according to Dr. Kane, gave 3·31 grains in 10,000, of which 0·15 were protoxide of iron. This, then, is a pure water, and no mineral water. Mallow has a temperature of 70°, and in 10,000 grains gives 2·01, and a large quantity of azote. If the views which some now entertain concerning nitrogen be correct, Mallow, especially along with its slight thermality, enjoys the dignity of being the only thermal spring in Ireland.

# PART V.

## MISCELLANEOUS MATTERS.

### DISEASES IN WHICH MINERAL WATERS ARE LIKELY TO BE EMPLOYED, *with references to the particular Mineral Waters suitable in each Disease or class of Diseases; and an enumeration of those Diseases in which Mineral Waters are likely to be either inefficient or positively injurious.*

THE diseases in which mineral waters are likely to be used, or in which they may be used with advantage, may be summed up as follows:—1. Skin Diseases; 2. Gout and Rheumatic Affections; 3. Neuralgia or Sciatica; 4. Surgical Affections, Sprains which have assumed a chronic character, old Wounds, Ulcers, Chronic Inflammation of Joints, Diseases of Bones; 5. Abdominal Enlargements and Congestive Affections; 6. Kidney Disease, or other disease of the urinary apparatus; 7. Diseases of Females, Nervous and Hysterical Affections; 8. Paralytic Diseases; 9. Diseases of the Chest; 10. Scrofula. Not but what even in this classification something must be left out.

1. *Skin Diseases.*—They have this advantage, that what affects them can be seen; whereas, in regard to some of the other classes, all or much is mystery. If a person affected with hysteria is better or worse, it is sometimes exceedingly difficult to tell, but when an eruption vanishes, there can be little doubt, at least with regard to the immediate effect.

If the eruption be of long continuance, and unattended with pain, and there be no tendency to congestion of the head, as a general rule hot baths will be beneficial, either those of the sea or of some salt or sulphurous spring; and if no other circumstance oppose, the internal use either of the saline or sulphur water may be conjoined. Of saline springs there are in this country Tenbury, Ashby-de-la-Zouch, Woodhall, Thorpe Arch, Gloucester, and Shap; the spas which also contain chlorides being more indicated—Pitkeathly, Airthrey, in Scotland. On the continent, Kreuznach, the Soole at Kissingen, Nauheim, Hombourg, Soden, all the saline waters of the Pyrénées, and generally any saline water; and as the object is stimulation of the skin, we may obtain this result by any thermal spring—Bath, Wiesbaden, Baden-Baden, the baths at Karlsbad, the hot baths of Ussat, the sulphuretted baths in this country, of Harrowgate, Askern, Moffat, Strathpeffer. Generally speaking, if the cold baths do not benefit, they will not injure, nor will the hot baths, unless there be a great deal of external irritation, or of an internal congestive state: if there be such a state, then the mild sulphur baths, as in this country Gilsland and Moffat, Weilbach in Germany, or the waters which, if thermal, yet contain few salts, and could be allowed to cool down to the requisite temperature to make them endurable without being stimulating, as the Pyrenean waters, which contain little except the sulphur. Waters such as Vichy or Ems, which contain soda, will have a good effect, or Schlangenbad, and almost all waters not highly mineralized or given at too high a temperature.

2. *Gouty and Rheumatic Affections.*—When these are of a chronic character, the whole class of thermal springs as baths and taken internally, always supposing that there is no tendency to cerebral congestion or heart disease. If such were suspected, Buxton in this country would be preferable to Bath; and on the continent, one like Uriage or Vichy cooled down, to the stimulating waters of the Pyrénées, or such as Wildbad, or any strong saline spring. Also if the affection be chronic, and this internal danger do not threaten, the strong saline springs or strong sulphurous springs may be both used externally and taken internally, whether thermal or not. The same rule does not apply to

the internal administration, if there be this tendency to internal congestions; the thermal springs, whether saline or sulphurous, or simply stimulating, are contra-indicated, not the cold saline springs, however strong, unless likely to irritate the bowels; for in internal congestive organic disease great benefit may often be derived from the ingestion of powerful saline waters, where their external administration would be injurious, hot or cold. It does not appear that gas baths of carbonic acid or other gases, are open to the same objection as other kinds of baths in such cases.

3. *Neuralgia or Sciatica.*—If the disease be simple, the whole class of thermal springs as baths, not given at too high a temperature. Bath, Baden-Baden, Wildbad, Gastein, Toeplitz, Plombières, Schlangenbad, Ems, Buxton; the soothing waters, like Ems, Schlangenbad, should in general be preferred to the stimulating ones, but the choice must be left to the judgment of the patient's physician. In many of these cases the internal use of the chalybeate sources, such as Spa, Pyrmont, Schwalbach, will effect a cure when the neuralgia is dependent upon want of tone in the system; or in other cases the strong alterative and saline springs, as Kissingen, or the same associated with sulphur, as at Harrowgate, or the powerfully alterative waters of Karlsbad used internally and externally. Douches thrown on the affected part are often particularly indicated in such cases. For the application of such douches, Aix, in Savoy, is especially famous,—carbonic acid baths and douches.

4. *Surgical Diseases.*—For sprains which have assumed a chronic character, Buxton is very famous; all the thermal springs likewise. Leuk and others abroad.

*Old Wounds.*—In this country Bath; abroad Barèges especially, above all others in France; Wiesbaden, Toeplitz, Aix (Savoy), Aix-la-Chapelle, all the places where establishments for military purposes are maintained by government, Bourbonne, Bourbon l'Archambault, Ax, etc., Gastein, Acqui in Piedmont.

*Ulcers.*—All the alterative and tonic waters taken internally; cold saline waters used externally, where the ulcers show deficient action.

*Diseases of Bones.*—All the thermal springs when the disease depends on a slow necrosis; those which are tonic administered internally—Bath, Karlsbad; the same waters generally as those which are beneficial in wounds.

5. *Abdominal Enlargements and Congestive Affections.*—All the saline sulphated, or chloruretted waters. Harrowgate, Leamington, Cheltenham, Kissingen, Karlsbad, Frederickshall, Franzensbad, Niederbronn, Hombourg, Baden (Switzerland), Marienbad. Those waters which are more powerfully purgative are to be preferred where there is congestion of the head, unless the state of the bowels is likely to cause them to produce too much irritation; when absorption of tumours is desired, it is best to employ a chloruretted water; when purgation is desirable, a sulphated one.

6. *Kidney Disease, or other disease of the urinary apparatus.*—As diseases of this kind are almost always of an irritant character, depending on the presence of gravel or calculi, or inflammation of the bladder, the remedies are almost always of a similar character, and the alkaline waters have a just superiority—Vichy, Ems, Salzbrunn—especially those which are thermal; then they probably act on the body in more ways than one, as has been explained. Another class of remedies are found beneficial, viz., the thermal waters, as Bath, Toeplitz, Wiesbaden. They probably act by diluting the blood, allaying irritation in the excited organ, allaying nervous irritability by their action on the skin, and by the same action relieving the kidneys. As a general rule, the strong chloruretted waters should be excluded in these cases. The sulphated waters may sometimes be useful by removing obstructions in the abdomen. Karlsbad is one of the waters most generally useful in those cases of diseases of the kidneys and bladder.

7. *Diseases of Females—Amenorrhœa, Dysmenorrhœa, Chlorosis, Irritability of the Uterus Engorgement of the*

*Uterus, Sterility.* — Amenorrhœa generally depends upon the state of the system. Alterative saline waters will do good when the secretions of the stomach, liver, and intestines are deranged, and where mild aperients also are indicated. In this country, Cheltenham, Leamington; abroad, Kissingen, and waters of that class. In cases of debility, where there is also chlorosis, the chalybeate waters, Tunbridge Wells, Scarborough, in this country, and sea-bathing; abroad, Spa, Pyrmont, Schwalbach. Dysmenorrhœa may depend upon many causes, often upon general irritability or a nervous state; thermal springs are especially indicated. In this country, Bath, Buxton; abroad, Wiesbaden, Schlangenbad, Neris, Plombières. The same applies to irritability and to a hysterical state. In unaccountable nervous phenomena, connected with the uterus, Pfeffers. In engorgement of the uterus, alterative and aperient waters, Cheltenham, Leamington, hot-bathing; Bath, ascending douches; abroad, Baden-Baden, Ems, Schlangenbad, Aix (Savoy), Plombières, Bourbon Lancy. In sterility there may be so many causes at work that it is difficult to fix on any one water. Some waters have an amazing reputation in this respect, especially on the Continent. See Spa, Gastein. Sea-bathing—Much depends on whether the affection is connected with organic disease.

8. *Paralytic Disease.*—Almost always the thermal waters, Bath, Buxton, Wiesbaden, Baden-Baden, especially Wildbad, Gastein, and Pfeffers. All depends on whether the disease be or be not organic.

9. *Diseases of the Chest. Pulmonary and Laryngeal Phthisis, Catarrh of the Bronchi.*—In the former case all depends upon the point as to whether the tubercle is formed, and how far it has gone; the object is to select a residence as well as, if possible, a water which may have some effect. And contrary to what is the usual case with regard to the selection of mineral waters, the residence is the primary object, the spa the secondary. In this country we cannot be said to have any water enjoying a reputation for the cure

of tubercle. It is different on the Continent. There these spas may be divided into two classes; some which are irritant, or rather excitant for phlegmatic temperaments, Eaux Bonnes, La Raillère, Labassière, Mont Dore, Vernet, Amélie les Bains, almost all thermal, and many sulphurous; for irritable and plethoric temperaments, Ems, Soden, Weilbach, Weissemburg, and Penticosa. Altitude, too, is an important element. For some temperaments a spa like Ems would be selected, because it lies low; for another, Eaux Bonnes, on account of the elevation. If in this country we have not spas which are supposed to have a sanative effect upon phthisis, we have localities, as Clifton, Torquay, Bournemouth, perhaps Moffat. The same that applies to incipient phthisis applies precisely to affections of the bronchi and to pulmonary catarrh. Places, as Vernet and Amélie les Bains, where an artificial climate has been created, deserve great consideration on account of this class of patients. The waters deemed to have an influence on these diseases are generally either alkaline or sulphurous; and it is worthy of observation that both may really, on physiological grounds, independent of experience, have some effect.

10. *Scrofula.*—All the saline springs of a chloruretted character. In this country Woodhall is recommended, on account of its iodine, the saline chalybeate at Cheltenham; on the Continent, Kreuznach; *the sea.* Where there is much skin affection at the same time, such a tonic as Schinznach, also sulphuretted and thermal. When the skin is much affected along with the disease, nearly all the sulphur waters, and the pure thermal waters where there is much irritation, and especially Schlangenbad. All the saline chalybeates, Scarborough, Marienbad, the bromo-ioduretted waters especially. Woodhall, Cheltenham, saline; chalybeate, Kreuznach. All pure chalybeates.

It is unnecessary to say that this can be considered only an approximation to an accurate statement. Anything like absolute accuracy is out of the question. The waters mentioned must be regarded as examples of the kind of water likely to be beneficial.

With regard to the diseases in which mineral waters are likely to be injurious, it is a general rule that all thermal waters are excitant. Consequently they are contra-indicated in all diseases of the heart and great vessels. In acute diseases generally they are inefficient, to say the least, and may be dangerous. Again, wherever an organic affection has terminated in the deposit of morbific matter, except in such cases as have been referred to of gout, enlargement of the liver, etc., the disease must be considered as beyond the reach of mineral waters. In acute gout and rheumatism it has been particularly shown that those waters, which are so very beneficial in the chronic forms of these diseases, are especially injurious.

Perhaps it is in hypochondriasis, scrofula, gout, and rheumatism, that the treatment of disease by mineral waters has met with the most brilliant success.

## Analysis of Mineral Waters.

The analysis of a mineral water divides itself into an examination of its physical qualities and of its chemical composition. Under the former head, the smell, taste, colour, limpidity, or turbidity come under consideration. The water, too, may with some important results be examined by the microscope for the presence of confervæ or various organic substances. The temperature should be noted, the mode in which the water is disengaged from the earth, and, generally speaking, as many facts connected with it as possible. The next thing is, by means of litmus and turmeric test paper, to ascertain whether it is acid or alkaline; then its specific gravity should be taken, which is best done by weighing it in a bottle containing exactly 1000 grains of distilled water. Of course this may be done by comparing the water with any given quantity of distilled water; and then, by a Rule of Three comparison, bringing the quantity to its proportion, as to 1000 parts of distilled water at 60°; but it is simpler, if such an apparatus be at hand, to take the bottle holding, as already said, 1000 grains of distilled water at 60°; then, of course, if the bottle filled with water to be examined should weigh 1004 grains, its specific gravity is 1004. The next thing is to determine whether the water is to be ranked among the carbonated or sulphuretted, or saline or chalybeate springs, its alkalinity or acidity having already been examined.

Free carbonic acid is determined to be present from the action of the water on litmus paper, which, if it be reddened before the water is boiled, and not afterwards, and the colour disappears on warming the test-paper, indicates the presence of this gas. Sulphuretted hydrogen is readily ascertained by the solution of sugar of lead, which immediately causes an intense black or brown precipitate when this gas is present. If the water, after being boiled some time, still gives a black or dark precipitate with sugar of lead, then the whole or a portion of the sulphuretted hydrogen is combined with a base; most likely the sulphuret of sodium is present. The presence of an alkaline carbonate will be shown by the liquid restoring the blue colour of reddened litmus after the water has been boiled. Iron is best indicated by suspending a chip of nut-gall by a string in the water, and leaving it for some time; say a day or two. If the water, without possessing any of these characters in excess, leaves a considerable residuum of neutral salts, it is then called simply a saline water.

Other general qualities of the water may be ascertained before proceeding to minute particulars, as whether it contains much organic matter, by the addition of a solution of nitrate of silver, which soon gives a reddish-purple precipitate with organic matter, and its hardness by what is called the soap test of Dr. Clark, of Aberdeen.

For the purpose of this test, in the first place sixteen grains of neutral chloride of calcium (prepared by solution of carbonate of lime, the purest marble, in muriatic acid, and repeated evaporation to dryness, and re-solution and evaporation in an air-bath until all the excess of acid is driven off,) are dissolved in a gallon of distilled water, which is then said to be of the sixteenth degree of hardness, and a soap solution is formed by dissolving 120 grains of Hawes' white curd soap in a pint of proof spirit. The former of these liquids is used to graduate the latter. A graduated apparatus is employed containing one hundred measures, each measure equal to ten grains of distilled water. One hundred measures of the solution are put into a stoppered bottle capable of holding twice the quantity of water. The soap solution is carefully added, and the bottle, with the stopper in, is agitated from time to time, and the soap solution added until the lather which is formed remains for five minutes on the surface of the liquid. This process is carried on until it is ascertained, by adding more soap or more spirit to the soap solution, that thirty-two measures of it will neutralize one hundred measures of water of 16° of hardness.

In testing the water, it is first violently agitated in a stoppered bottle, to get rid of any carbonic acid it may contain, and the air disengaged sucked out, and this is done until it is supposed to be free of carbonic acid. The soap solution is then added to one hundred measures of it in a stoppered bottle, and the mixture is treated as above described, and the hardness estimated from the number of measures of soap solution required to cause a permanent lather, to be formed according to the subjoined table :—

| Degrees of Hardness. | Measures of the Soap Solution. |
|---|---|
| 0° | 1·4 |
| 1° | 3·2 |
| 2° | 5·4 |
| 3° | 7·6 |
| 4° | 9·6 |
| 5° | 11·6 |
| 6° | 13·6 |
| 7° | 15·6 |
| 8° | 17·5 |

| Degrees of Hardness. | Measures of the Soap Solution. |
|---|---|
| 9° | 19·4 |
| 10° | 21·3 |
| 11° | 23·9 |
| 12° | 24·9 |
| 13° | 26·7 |
| 14° | 28·5 |
| 15° | 30·3 |
| 16° | 32·0 |

When the water is so hard that it will not yield a permanent lather with thirty-two measures of the soap solution, it must be diluted with an equal bulk of distilled water, and the solution of soap applied as before, and the process must be carried on till sixty measures of the soap solution have been used. If no result still be obtained, other one hundred measures of water must be added, and the soap solution added till ninety measures of it have been used; then the number of soap measures used must be divided by the number of one hundred measures in the mixture, and the quotient placed opposite the number of degrees in the table. Finally, this must be multiplied by the same quotient for the true number of degrees of hardness. The number of degrees of hardness nearly corresponds to the quantity of carbonate of lime reckoned in grains, equivalent to the lime, magnesia, alumina, and iron in the gallon of the water, reckoning the hardness by grains corresponding to the degrees.

At least so it is said, but I have great doubts whether this be the case; the hardness is sometimes not in such exact proportion. Almost all mineral waters are hard.

The analysis, after the sensible qualities of the water have been determined, now resolves itself into two parts, the first object being to determine what substances exist in the water; and, second, in what quantities these do exist. The first mode is termed qualitative, and the second quantitative; the analysis of a water may be carried almost to any extent.

Four classes of substances exist in a mineral water:—First, the acids; second, the bases; third, the organic bodies; fourth, the neutral gaseous principles.

The acids are the carbonic, free or combined with bases; sulphuretted hydrogen, free or as a soluble sulphuret or sulphide; silicic acid, boracic acid, sulphuric acid, phosphoric acid, chlorine, bromine, iodine, fluorine, nitric and humic acid.

Bases—Potassa, soda, lithia, ammonia, magnesia, lime, baryta, strontia, protoxides of iron and manganese, alumina, copper, lead, tin, antimony, and arsenic.

The organic bodies are chiefly the humic, crenic, and apocrenic acids.

The neutral gases are nitrogen and oxygen, and occasionally carburetted hydrogen.

The qualitative analysis of the water will be first divided into that of its solids and of its gases. The former should be first sought for, except when the quantity of water that can be obtained is small, and it is desirable to analyse for the gases. The solids, salts, the carbonic acid, and sulphuretted hydrogen, are the most important elements.

It is first well to test the water, with the exceptions below, before boiling or any other operation has been performed. Potassa or soda, however, is not often to be detected in the unconcentrated water. For the purpose of ascertaining the presence of potassa or soda, a quantity of the water, but not less than a quart, is to be boiled down. The residue is dissolved in a little water, and divided into two portions; a drop or two of muriatic acid is to be added to one of them, and then some of the bichloride of platinum. If a lemon-yellow coloured precipitate forms, then potassa is present. The other portion may be evaporated to dryness, and a portion of the residue exposed on a piece of platinum foil to the reducing or inner flame of the blowpipe. If it give a yellow colour to the outer flame, soda is present. If potass be present in anything like considerable quantity, it will give a precipitate with tartaric acid. Soda is thrown down by the meta-antimoniate of potass, as a white precipitate from its solutions, but all the alkaline earths and metallic oxides must have been previously removed; that, however, is not difficult.

Lithia may be supposed to exist in the residue if it give a red carmine to the flame of the blow-pipe, or fused with carbonate of soda on a platinum foil, it gives a yellow tinge.

A strong solution of ammonia is recognised by its fine blue colour with sulphate of copper; salts of ammonia are recognised by heating the residuum of the water with potass, and collecting the disengaged vapours in weak muriatic acid, whence they can be driven off by potass, and recognised by test-paper moistened exposed to the fumes, ammonia being the only volatile alkali. Ammonia salts with chloride of platinum give similar precipitates to those with potass; only the salt thrown down from ammonia, heated with potass, yields ammoniacal fumes. If baryta be present, the sulphate and chromate of strontia will precipitate it, so will phosphate of soda, yielding a precipitate soluble in muriatic, nitric, and acetic acids. Hydrofluosilicic acid will give a transparent gelatinous precipitate, and the salts, if in any quantity in the precipitate, will cause an alcoholic solution to burn with a yellowish-green flame. Strontia gives no precipitate with the hydrofluosilicic acid; it is alsod istinguished from baryta by transforming it, if in the form of a carbonate, into a chloride, and dissolving it in alcohol, then setting fire to it, when it burns with a red flame; it also gives a red colour to the flames of the blow-pipe.

Lime is recognised by its abundant precipitate with oxalate of ammonia; its residual salts give a yellowish-red flame when their alcoholic solution is burned. When it is mixed with strontia or baryta, these two last should be got rid of by precipitating with dilute sulphuric acid or sulphate of potass; then boiling, filtering, neutralizing by ammonia; then adding an oxalate. Magnesia is ordinarily detected by its gelatinous precipitates with the alkaline carbonates, completed by boiling, also by its precipitation with ammonia;

but perhaps the best test consists in adding muriate of ammonia and a mixture of ammonia and phosphate of soda, when crystals of the ammonio-magnesian phosphate, recognizable by the microscope, are thrown down. If a magnesian residue be calcined upon coals by means of the blow-pipe, the calcined salt moistened with nitrate of protoxide of cobalt, and this calcined strongly again, the salt takes a palish red colour. To separate magnesia from baryta, strontia, and lime, the mixture is treated with carbonate of ammonia and another ammoniacal salt or free ammonia, the magnesia then remains in solution; on heating gently, the baryta, strontia, and lime are thrown down. In the filtered liquid the presence of magnesia can be recognised if, after a time more or less long, there form, after the addition of phosphate of soda, a crystalline precipitate.

To seek for potass, soda (lithia), besides magnesia and other alkaline earths, the following modes may be adopted:—First, by means of phosphate of soda and heating the liquor, to which free ammonia and some drops of a solution of sal ammoniac have been previously added, the alkaline earths are precipitated in the form of phosphates; then the filtered liquid is treated with acetate of lead, to remove the excess of phosphoric acid: finally, to get rid of the excess of lead, ammonia and carbonate of ammonia are added. The liquid filtered again contains, besides the ammoniacal salts, the alkalies which remain after evaporation and calcination. The filtered liquid is evaporated to dryness, and calcined to drive off the ammoniacal salts, the residue treated with water, water of baryta added to the solution as long as a precipitate is formed, then the liquid is heated and filtered. The excess of baryta of the filtered liquor is precipitated by carbonate of ammonia or sulphuric acid; the liquid is again filtered, evaporated, and the residue containing the alkalies calcined.

Ammonia and hydrosulphate of ammonia do not precipitate the alkaline earthy salts (lime, baryta, magnesia), soluble in water when a sufficient quantity of a salt of ammonia is present. Alumina is thrown down by the addition of ammonia to the water; first, with muriatic acid, and then ammonia added to it. It may be recognised by heating it strongly before the blow-pipe, then moistening it with a solution of cobalt and heating it again.

For the other bases the qualitative tests are of a simple character; the most difficult, perhaps, will be to detect a small quantity of manganese where there is much iron. In order to effect this the residuum, thrown down by hydrosulphate of ammonia, is dissolved in muriatic acid, the solution boiled, neutralized with carbonate of soda, and acetate of soda added, then supersaturated with ammonia, and a few drops of hydrosulphate of ammonia added; the precipitate which forms is tested by fusing it with carbonate of soda and saltpetre. If the melted mass is of a greenish colour there is manganese; it should in melting before the blow-pipe tinge the outer flame green.

The tests for the other metals are of a simple character.

When a water contains organic matters, the residue of the evaporation acquires a brown colour when heated. The solution also blackens when treated with nitrate of silver. In order to discover the humic acids, the ochrey deposit formed on boiling the liquid is boiled during several hours with potash, and the acetate of copper is added to the filtered liquid; supersaturated with acetic acid the apocrenic acid is precipitated; if the filtered liquid gives with heat a new precipitate with carbonate of ammonia, there is also crenic acid.

### THE ACIDS IN WATERS.

The next point is to determine what acids exist in combination with the bases. There will generally be the sulphuric, muriatic, carbonic, and hydrosulphuric; more rarely the phosphoric, nitric, hydrofluoric, and silicic.

The water is to be put into test-glasses as before. A certain portion is to be rendered acid by the addition of muriatic acid, to which a solution of muriate of baryta is to be added; if it contains sulphuric acid, a precipitate will be produced insoluble in all the dilute acids.

To another portion of the water a little nitric acid is added, and then a solution of nitrate of silver. If the mineral water contains sulphuretted hydrogen, or a soluble alkaline hydrosulphate, a solution of the sulphate of copper should first be added; thus the sulphur is all precipitated as sulphuret of copper, which is gradually thrown down at the end of a short time. It is to be collected on a filter. And then the filtered liquor may be treated, first, with a little nitric acid, and then with solution of nitrate of silver, which throws down the muriate or chloride of silver, if muriatic acid, in the form of a muriate or chloride, exists. A bromide or iodide would be thrown down in the same way by nitrate of silver. By treating the precipitate with chloride of lime and muriatic acid, either the bromine or iodine, or both, thrown down along with the chloride, will be set free. The best way of recognising the presence of iodine is by suspending, by means of a loosely-fitting cork, in the top of the tube or flask in which the process is performed, a piece of cotton thread or filtering paper, steeped in solution of starch, when, if iodine be disengaged, the thread will be turned blue. In the case of bromine acting in the same way upon the precipitate, if red fumes of bromine be disengaged, the experiment is satisfactory, but the best way is to pass the fumes by the aid of a gentle heat into a weak solution of potass, and test with chloride of gold, which gives a splendid red hue if bromine be present.

Another portion, as fresh as possible, is to be treated with lime-water; if a precipitate be obtained which is soluble in excess of the water, then carbonic acid is present, in the free state or in excess of any alkaline carbonate with which it may be combined. The presence of sulphuretted hydrogen is readily indicated by its reactions with metals.

Phosphoric and hydrofluoric acids exist in minute quantity, in combination with lime, in many mineral waters. It is seldom possible to detect these acids by an ordinary examination. The most likely mode is to concentrate the water to a sixteenth, when, as the compounds with lime are very insoluble, they will probably be precipitated. The precipitate is to be collected, and treated with muriatic acid in a platinum crucible, and any carbonate converted into a muriate. This is then dissolved and saturated with ammonia in a stoppered bottle, and the clear liquid decanted, after it has stood some time, from the precipitate. The precipitate is to be collected on a filter, washed, dried, and heated in a crucible with strong sulphuric acid. The top of the crucible is to be covered with a glass plate, spread with a layer of wax, with characters cut upon it. If, in removing the wax, it is found that these are acted on by the fumes which had been disengaged, it may be concluded that there is hydrofluoric acid. What remains in the crucible should then be treated with boiling water, and precipitated by adding muriate of baryta, and the precipitate treated with muriatic acid; thus sulphate and phosphate of baryta are thrown down, and the latter is again dissolved. The solution is to be treated by acetate of potass in excess, and thus the muriatic acid is replaced by the acetic; solution of sesquichloride of iron is then added. If a white gelatinous precipitate falls, phosphoric acid is present.

Small quantities of phosphoric acid may be recognised by means of the molybdate of ammonia; when this substance is added to the solution of a phosphate, and then muriatic or nitric acid in excess, and the solution heated, it becomes coloured yellow, and after a time a yellow precipitate of the molybdate of ammonia, enclosing phosphoric acid, falls. This precipitate is soluble in ammonia. Arsenic acid gives the same reactions.

Silicic acid is best ascertained to be present by evaporating a given quantity to dryness, treating then the precipitate for a short time with muriatic acid, using little more than will well moisten the silica. The mass is then to be treated with water. What remains is to be examined with the blow-pipe. Thus, if silica be present in any quantity, on fusing the mass with a salt of phosphoric acid, there will be a bead of silica left in the melted mass. Again, if it be fused with carbonate of soda it will dissolve with effervescence, and form a clear glass, either quite colourless or of a slightly yellow tinge if any iron be present.

Nitric acid generally proceeds from organic decomposition. It is frequently found in well water, and may be formed in the atmosphere, especially during thunder-storms. In order to obtain proof of its presence the water should be greatly concentrated, then the solution, separated from the residuum, treated with strong sulphuric acid, and a crystal of the green sulphate of iron. If nitric acid be present the iron will be peroxidized, and a red colour produced. The gases present must, in the case of all except carbonic acid and sulphuretted hydrogen, be separated from the water by boiling, which was formerly a very difficult operation, but an apparatus has been invented by M. Bunsen which renders it much easier. Between the flask in which the water is boiled and the mercurial trough in which the tube from the flask terminates, is interposed another flask, generating steam, and a receiving bottle, with stop-cocks. As soon as this apparatus is filled with steam, the apparatus generating the steam is removed, and heat applied to the mineral water, which has thus space, as it were, in which to boil and give off its gas, the vessel interposed between it and the mercurial trough representing a vacuum, as far as air is concerned. Formerly the great difficulty was in filling the flask so as to keep out atmospheric air and yet leave space for ebullition. The process will be best explained by a diagram, such as can be seen in Professor Hofmann's paper on the "Analysis of Harrowgate Water," in the *Journal of the Chemical Society* for 1855.

The gases collected are then analysed. Carbonic acid and sulphuretted hydrogen can both be removed by caustic potass. The amount of oxygen is easily ascertained by introducing fragments of phosphorus into a jar. Carburetted hydrogen will give its own volume of carbonic acid when detonated with oxygen. Nitrogen is usually supposed to exist from its negative qualities. All the metallic solutions almost will absorb the sulphuretted hydrogen. Chlorine also will remove the carburetted hydrogen. The carbonic acid and sulphuretted hydrogen may be removed by passing the gases through a solution of sugar of lead. The carburetted hydrogen may be removed by means of chlorine, and the chlorine completely by potash, leaving residual oxygen and nitrogen.

What has been said may perhaps suffice to give a general idea of the qualitative examination of mineral waters. A good deal must, in all cases, be left to the tact of the examiner and his general knowledge. The extent to which these examinations may be pushed must depend upon the time and means at the disposal of the analyst; the easiest processes, as far as qualitative analyses go, are perhaps for some of the metals. As a general rule, if a water contains a metal, and a quantity be evaporated to dryness, and acidulated with nitric or sulphuric acids, the metal may be detected by the ordinary tests; it is not, as in the case of poisoning, where the metal, arsenic for instance, is mixed with organic matter, and the great object of the analysis is to get rid of this. The processes for the gases are the most difficult, but they may be simplified. Thus the presence of sulphuretted hydrogen and carbonic acid, the most common gases, is of easy recognition. Some idea of the nature of the gases expelled by the boiling process may be gained from their quantity. If very small in quantity, probably nothing but atmospheric air is present. If the quantity expelled be considerable, it may be divided into more than two portions for examination. If the gas will not support combustion, is not absorbed by potassa, and is not inflammable, it is azote; if it support combustion more brilliantly than air, then in whole or in part it is oxygen; if it burns, it is hydrogen or carburetted hydrogen. The former burns with a feeble bluish flame, and if mixed over water with an equal volume of chlorine, and exposed to sun light, it is gradually converted into muriatic acid, which is absorbed; while the carburetted hydrogen burns with a brilliant flame, and if mixed with an equal volume of chlorine over water it is absorbed, and there appear on the surface little drops of oil, while the water acquires an ethereal odour.

I have not the pretension to give anything like a treatise on the analysis of mineral waters, but it seemed likely that some of the medical practitioners into whose hands this manual would fall might wish to have some directions which might serve at least to guide. In point of fact, a complete guide to the analyses of mineral waters would be a guide to analyses generally. For instance, if we go beyond that very ordinary constituent, iron, and get other bodies—metallic substances—associated with it, all the rules for separating the various metals come into play.

## QUANTITATIVE ANALYSIS OF A MINERAL WATER.

It has been already observed in the body of the work that an analysis of a water, both qualitative and quantitative, does not, *per se*, give an exact idea of how the bases and acids may be arranged in the water. The rule is, when it is known that a water contains such and such acids and bases, to give the strongest bases to the strongest acids, and to follow this rule until both be exhausted. Thus, suppose sulphuric and muriatic acid exist in a water, and soda and magnesia, all the sulphuric acid would be given to the soda, as far as it was capable of saturating the soda. Any soda left over would be given to the muriatic acid, as far as it would go; any sulphuric acid left over beyond what was required to saturate the soda would be taken to the magnesia; so that every qualitative analysis depends for its completion upon the determination of the quantities as well, since, unless we know the quantities, we cannot arrange the elements.

The total amount of solids in a mineral water is easily ascertained. About a pint at least of the water is evaporated to dryness slowly in a porcelain dish, covered with a paper funnel, and transferred by degrees to a weighed platinum vessel, into which also any deposit left in the original vessel is carefully washed with distilled water. The whole is then evaporated to dryness by means of hot air if possible, if not, by a salt-water bath. It is then weighed; the weight gives that of the whole of the solids. The whole is then to be strongly calcined, and weighed. The loss of weight gives the amount of the organic substances which have been destroyed.

Next, half a gallon of the water may be evaporated in a similar way, with a few drops of nitric acid; the residue is to be treated with dilute muriatic acid, which removes other bases and leaves silica, which can be weighed. The solutions and the washings of the residue (which are to be collected on a filter, well washed, and ignited with the filter, are to be weighed), are then to be treated with ammonia, which throws down the alumina and iron. These are to be collected on a filter, washed, ignited, and weighed. The lime is to be thrown down from the residual solutions, as oxalate, by means of solution of oxalate of ammonia. The precipitate is collected on a filter, washed and dried; it is then incinerated with the filter; the result is then treated with some strong solution of carbonate of ammonia, dried in an air-bath. The result is carbonate of lime, from which the weight of lime originally in the water can be calculated. (In all these cases the analyst consults tables which tell him the amount per cent. of acid and base in the substances resulting from his analysis, whence of course, by a simple Rule of Three calculation, he obtains the proportion of acid and base in what he has weighed).

The residual filtered solution and washings are then treated with solution of muriate of ammonia, and excess of solution of phosphate of soda added. The mixture is then well stirred and set aside for several hours; the precipitate is collected on a filter, and washed with water containing a little ammonia. The precipitate dried and ignited is pyrophosphate of magnesia, from which the magnesia can be calculated.

The mixed precipitate of alumina and iron having been weighed, is dissolved in dilute muriatic acid. It is then heated in a silver vessel with excess of solution of pure potassa, and the precipitate washed with hot water; dissolved again in muriatic acid thrown down by ammonia, washed, dried, and ignited. It is the peroxide of iron, which probably existed as protoxide in the water. The residual solution, after the iron was precipitated by the potassa, treated with ammonia, gives the alumina, which, however, could now be calculated by separating the iron from the weight of the two.

To determine the potassa and soda, a quart or two of the water is again to be concentrated by evaporation, till the bulk is reduced by four-fifths, then treated with solution of chloride of barium and baryta; the solution is then to be heated, and separated by filtration from the precipitate. The solution and washings of the filter are evaporated and greatly concentrated, then treated with ammonia and carbonate of ammonia, to separate any excess of baryta, heated to dryness in a weighed dish, and then the residuum weighed. It is composed of chlorides of potassium and sodium; the residue is dissolved, and mixed with a little muriatic acid and bichloride of platinum, the solution evaporated to dryness and treated with anhydrous alcohol, which leaves the double chloride of potassium and platinum. The weight of this gives, by calculation, the weight of potassium, and this, taken from the chlorides of sodium and platinum, the weight of chloride of sodium.

It is not difficult to determine the weight of the acids ordinarily found in mineral waters. The sulphuric and muriatic are generally determined by acidulating the water with muriatic acid and nitric acid, and then adding in the one case muriate of baryta for the sulphuric, and nitrate of silver for the muriatic acid, collecting, washing, and drying, and in the latter case fusing the precipitate in a weighed platinum crucible. Carbonic acid should be determined at the spring by introducing chloride of calcium and ammonia into bottles of the water; the precipitates obtained from the different bottles being mixed, and the whole collected on filters, they are to be ignited with the filters and weighed, both when just ignited and on cooling, and after some exposure to the air. Thus the total amount of carbonic acid is ascertained.*

The precipitate produced by boiling the water will be composed of carbonates of lime, magnesia, and iron. In this the quantity of lime, magnesia, and iron should be determined. From this determination the quantity of carbonic acid combined with them can readily be calculated. For this purpose about half a gallon of the water, or at least a quart, unless the water be very strong in carbonates, is boiled for an hour, and fresh *distilled* water must be added to keep the quantity of water at its original bulk, and prevent any deposit of the sulphate of lime. At the end of an hour the precipitate is well washed, and then treated with weak muriatic acid, and the solution boiled with a little nitric acid. From the solution the iron can be precipitated by ammonia, the lime as oxalate of ammonia, and the magnesia as phosphate.

Lastly, the alkaline carbonates can be determined by boiling a quart or two of the water for an hour; the whole should then be filtered, and the precipitate well washed with distilled water, and the washings added to the filtered liquid. This should be divided into two parts, both of which are to be weighed; in the one the chlorine is to be determined by the addition of nitrate of silver, the other is to be acidified by muriatic acid, and evaporated, ignited, and the chlorine determined in it also in the usual way. The presumption is, that the first portion of the water gives the soluble chlorides existing in the water; the second, the addition made to these by the decomposition of the alkaline carbonates, whose amount can thus be calculated by subtracting the one from the other.

---

* The water should be removed at the spring by means of what is called a mineral water syphon. This is a glass vessel, capable of holding about twelve ounces. It should be open at both ends; of the form of what is known as an adapter; so narrow at the top, that it may be closed by the thumb. By dipping the open end into the water, and, when the vessel is full, closing the narrow end with the thumb, the water can be transferred to appropriate bottles, well stoppered, holding about a pint.

Sulphuretted hydrogen may be determined in several ways. One method consists in inserting into the bottles filled by the syphon at the spring a little muriatic acid and some solution of arsenious acid, and after some time collecting the precipitate, which is sulphuret of arsenic, and from which the amount of sulphuretted hydrogen can be determined.

If a solution of iodine in iodide of potassium be gradually introduced into a water containing sulphuretted hydrogen, and a solution of starch be present, the iodine decomposes the sulphuretted hydrogen, forming hydriodic acid, and the water becomes milky from precipitation of sulphur, but no colouration of the starch will take place until all the sulphuretted hydrogen is decomposed; but as soon as this takes place, and hydriodic acid ceases to be formed at the expense of the sulphuretted hydrogen, then the free iodine colours the starch in its characteristic manner. If the solution of iodine be of a known strength, and introduced from a graduated pipette, then the amount of sulphuretted hydrogen, free or in combination, can be calculated; for every equivalent of iodine, added before the change of colour took place, corresponded to an equivalent of sulphuretted hydrogen.

The quantities of chlorine, bromine, and iodine in a water containing them all, are determined by a laborious process:—First, the precipitate with the three is treated with bromine, *i.e.*, an atmosphere of bromine is passed over it, and in this it is fused until it no longer varies in weight. From the difference between its former weight and the weight which it obtains, the quantity of iodine lost is calculated, according to the difference between the equivalents of iodine and bromine. By a similar process the bromine is replaced by chlorine being melted in a dry atmosphere of this gas.

The metal most commonly associated with iron is manganese. From this the iron may be separated by dissolving the precipitate obtained by hydrosulphate of ammonia, which will contain both iron and manganese, in muriatic acid, adding a little nitric acid, then ammonia and chloride of ammonium (muriate of ammonia added), and the iron being thrown down by means of ammonia, the manganese remains in solution, and can be thrown down by hydrosulphate of ammonia. The peroxide of iron is washed with distilled water and a little ammonia, ignited and weighed as sesquioxide of iron; the manganese as sulphuret of manganese.

Arsenic should be determined by evaporating to dryness a large quantity of the liquid, and separating as much as possible the other substances by suitable tests—taking care to employ no substance which can separate the arsenic—and then throwing down the arsenic from the residuum dissolved in muriatic acid by a stream of sulphuretted hydrogen; or by digesting the residue with copper filings and muriatic acid, collecting the filings, heating them in a tube, and carefully weighing the deposit collected. Its presence may be ascertained by Marsh's test.

With regard to the analyses for gases—carbonic acid and sulphuretted hydrogen can readily be removed by the action of potassa and nitrate of silver, the other gases being carburetted hydrogen and nitrogen; the former can be separated by chlorine or detonation with oxygen, and the amount of the latter can then be determined. The sulphuretted hydrogen, set free by boiling, may be determined from the quantity in the residual liquid, either by the iodine test of M. Dupasquici, or by adding ammonia to the water, and then solution of nitrate of silver. Then collecting the precipitate, washing the precipitate first with ammonia, and then dilute acetic acid and distilled water, and drying at 212°, until the precipitate no longer loses weight. It is then weighed as sulphuret of silver; and in the difference given, by whatever test is used, between the results before the water is boiled and afterwards, will be found an approximation between the amounts of free and combined sulphuretted hydrogen—or the amount of the sulphuretted hydrogen and sulphurets in the water.

## CARBONIC ACID GAS AS A PRODUCT OF NATURE.

The following account of the natural history of carbonic acid waters and blowers of the gas is extracted from the *Grundzuge der Mineralquellenlehre of Lersch*, pp. 85–87.

"Carbonic acid springs from the earth in cold, but more frequently in warm streams, in many places mixed with watery vapour. One of the most remarkable instances of this kind is the Lagoni in Tuscany, a hilly district, which, for a circuit of many leagues, is without any signs of vegetation, and is continually enveloped in a whitish, unpleasant-smelling mist; the surface is constantly broken up by the frequent shifting of the jets of gas and vapours. In some spots it is dry on the surface, and often burning hot; in others muddy puddles appear. In these, at a shallow depth, there is invariably a fluid mass of warm water, mixed with mud or slime. The gas and vapour spring up with great force through the clefts and openings of the hard crust of the earth. These are called suffioni (blowers): the temperature of this vapour is given at 97° to 100°; in other places it is mixed with sulphur, but that in small proportion; it is then called solfataren. Tepid gas springs out dry, at a low temperature of the atmosphere. At the Grotto del Cane, not far from the steppes of San Germano, which is composed of blue tuffa, the temperature of the air is 27·5° to 16°, and the gas which streams out is not perceptibly mixed with moisture. Dry streams are most frequently cold, or at least not more than lukewarm, as in the Grotto of Pyrmont. Macard measured the heat of the vapour, in the hot summer of 1785, and he generally found the temperature of 61¼° to 62½° Fah.=16·4 to 17·5 C., and a very low position of the vapour, 61½° Fah., at the very high atmospheric temperature of 88° Fah. in the shade. When Seip says that the vapour streams through the snow without melting it, its temperature cannot be very high. Brandes found that when the temperature of the air was at 17·7°, the temperature of the vapour was 15·4°. In winter, when the temperature was 2°, the vapour was only 4°.* It must be remarked that these air streams come through the fissures of cold damp stone, which at different times may cool it more or less. When such external influence does not exist, the temperature of the carbonic acid is more regular. Bischof found in Brohthal, which he had often examined, that the gas streams were always of the same temperature as the springs of water."

## THE GEOLOGICAL CONDITIONS AND EXTENT OF THE CARBONIC ACID GAS STREAMS.

Jets of gas through the earth's surface most frequently occur where there are waters of unusual composition, acidulated, and both are found where volcanic action has undoubtedly reigned, and where a dislocation of the strata has taken place. When a water-tight stratum is broken through, the carbonic acid gas makes itself a path to the surface, as is seen in Westphalia, in the vicinity of Pyrmont and Driburg; where there are powerful dislocations, strong streams of carbonic acid gas come to the surface. These streams come out of the sandstone at Meinberg, near to Keuper, at the place where the stratification is perpendicular, or nearly so. Hofmann has examined these circumstances in a large tract of land on the left bank of the river Weser. From Karlshafen to Blotho, one German mile from the new salt works, at every place where the shell limestone gives way, to a substantial extent, to the variegated sandstone, the carbonic acid gas comes out at the brinks or edges, as at the mineral springs of Godelheim and

---

* Centigrade is understood when Fahrenheit is not named in the work of Lersch.

Hörtez, in the valley of the Weser; as also in the salt spring of Karlshafen, and in the acidulated fountains of Hofgesimar, etc. Carbonic acid gas flows not unfrequently out of bored wells. Seventeen Artesian wells in Wurtemburg are strong in carbonic acid, etc. Acid springs are found in great numbers in the neighbourhood of extinct volcanoes or in hilly districts of crystalline formation, particularly basalt. They are also found rich in carbonic acid in places where apparently no such indications exist, and where there are not even hills. But such localities are always found, on examination, to be of Plutonic origin. A closer survey of the environs of such places will show that at some earlier period the appearing of the volcanic masses had shattered, though not dislocated, the stratified rock, so as to allow the carbonic acid gas to make its way through to the surface. To these places, where the development of carbonic acid gas takes place on the surface of the earth, whether covered with water or otherwise, belong the so-called Grotto del Cane, near the Lake Agnano, four leagues from Naples, and the caves in the lava stream from Clermont to Royat, in Auvergne. Among the most famous of the caves of Montjoly is the so-called Puits de Negrac, or Puits de la Poule, in Vivarais; also the exhalations at Sciacca, in Sicily. Besides these, there are in the vicinity of Mount Vesuvius many places where occasional exhalations take place, and where, at each volcanic eruption, the gas streams forth plentifully.

In Germany there are many acidulated springs. They are found in the following mountainous districts :—In the Eifel, in the middle of the Laacher Lake, in the Westerwald and the Taunus, the Habishtswald, the Meissner, the Bogelgebirge and the Rhone, the Fichtelgebirge, the Erzgebirge, the Bohemian Mittelgebirge, and the Beiseingebirge. In all these places they are more or less numerous, and with a greater or lesser development of carbonic acid gas. They follow exactly the basaltic features of the Eifel as far as the Beiseingebirge. Frequently there are a great many acidulated springs grouped together in a small compass. In a circuit of three leagues round Marienbad there are one hundred and thirty-four sour springs, seventy-three of which are in the Government of Teppel.

The phenomena produced by the Grotto del Cane are well known; but one of the most remarkable instances of the discharge of this gas from the earth is probably found in the Valley of the Upas-tree in Java. It seems to be well authenticated that this valley owes its poisonous atmosphere to carbonic acid gas. Skeletons of animals, and even men, are strewn about the place. But perhaps a still more extraordinary instance is that of the mountain Buzhan Bhota, in Thibet, as described in Huc's Travels. Carbonic acid is disengaged in such abundance that the mountain is almost rendered impassable, especially in calm weather, when there is no wind to dissipate the gas. It is worthy of observation that the mountain seems to be volcanic, for not far off are found hot springs, whose remedial powers were highly valued by the natives.

Lately, near the Grotto del Cane, another cave has been discovered by the Prince of Capua, which secretes ammonia. The gas, notwithstanding its specific gravity, remains on the floor of the cave. There is no smell in the air of the Grotto. On putting reddened litmus near the floor, it is turned blue, and muriatic acid produces white fumes. The distinct smell of ammonia also is perceptible near the floor.

It appears that the gas has already been applied medicinally as a remedy in amaurosis. Animals placed on the floor of the Grotto died even more rapidly than in the Grotto del Cane. The gas produces a sensation of prickling and heat in the limbs.

## CONFERVÆ IN MINERAL WATERS.

The hue of confervæ is almost universally green, in a few instances varying to a brownish-orange colour, or purplish. They are met with in fresh-water pools, ditches, and rivers, as well as in the sea; but almost all of the species belong to cold and temperate climates, where, in the summer months especially, scarcely any water exposed to the air and sun is without them. The fresh-water species of these, indeed, are among the most important of the Algæ, as regards their agency in ameliorating the unwholesome character of that element in its stagnant state. Many of them contribute very largely, by their annual growth and decay, to the filling up of the pools in which they vegetate, and converting them, with the after assistance of mosses and other plants of higher organization, into marshes.

The name *conferva* was bestowed by the Romans on some plant of this family, used by them as a dressing to fractured bones from *conferruminare,* to unite or consolidate, a property which it was supposed to possess. (*Smith's English Botany,* by Sowerby. Second Edition, vol. xii. p. 158.)

Oscillatoria, or Conferva Tenuissima, first found by the Rev. Dr. Davies in the warm springs of Bath.—p. 185. Diameter of the filaments eight or ten thousandth of an inch.

Tremella, a kind of gelatinous fungus.

## TABLE OF THE MEAN TEMPERATURES OF THE YEAR IN SUMMER AND WINTER, IN DIFFERENT PARTS OF THE GLOBE. THE DEGREES ARE ACCORDING TO THE CENTIGRADE.

| PLACES. | LATITUDE. | YEAR. | WINTER. | SUMMER. |
|---|---|---|---|---|
| Convent of Saint Bernard... | 45° 15'N. | — 1° 1 | — 8° 0 | + 5° 9 |
| Petersburg ........................ | 59 56 | + 2 8 | 8 7 | 16 0 |
| Moscow............. ......... | 55 45 | 3 8 | 10 2 | 17 5 |
| Christiana ........................ | 59 54 | 5 3 | 3 7 | 15 8 |
| Stockholm........................ | 59 20 | 5 6 | 3 7 | 16 3 |
| Copenhagen ..................... | 55 41 | 7 7 | 0 9 | 17 2 |
| Berlin ........................ | 52 33 | 8 1 | 1 0 | 17 2 |
| Dresden........................... | 51 4 | 8 3 | 1 2 | 17 2 |
| Edinburgh ........................ | 55 57 | 8 4 | + 3 5 | 14 1 |
| Ratisbon ........................ | 49 01 | 8 6 | — 1 5 | 17 9 |
| Zurich ............................ | 47 23 | 8 9 | 0 9 | 17 9 |
| Hamburgh .................... | 53 33 | 8 9 | + 0 4 | 19 0 |
| Basle............................... | 47 34 | 9 1 | — 0 2 | 17 6 |
| Dublin ............................ | 53 23 | 9 6 | + 4 0 | 15 3 |
| Boston ............................ | 42 21 | 9 6 | — 1 4 | 21 0 |
| Geneva ............................ | 46 12 | 9 7 | + 0 9 | 18 4 |
| London ............................ | 51 31 | 9 8 | 3 2 | 16 7 |
| Frankfort-on-the-Main...... | 50 .6 | 9 8 | 1 4 | 18 3 |
| Strasburg ................ ... | 48 35 | 9 9 | 1 3 | 18 1 |
| Prague ............................ | 50 5 | 10 0 | — 0 4 | 19 9 |
| Vienna ..... .................... | 48 12 | 10 4 | + 0 2 | 20 4 |
| Paris ............................... | 48 50 | 10 8 | 3 6 | 18 0 |
| Rochelle ............ ......... | 46 9 | 11 7 | 4 8 | 19 2 |
| Trieste ............................ | 45 39 | 14 6 | 5 7 | 23 6 |
| Marseilles........................ | 43 18 | 14 6 | 7 3 | 22 7 |
| Rome.............................. | 41 54 | 15 5 | 8 3 | 22 8 |
| Lisbon ............................ | 38 42 | 16 3 | 11 4 | 21 6 |
| Buenos Ayres ................ | 34 36 S. | 17 0 | ... | ... |
| Cape of Good Hope ......... | 33 56 | 19 2 | 14 8 | 23 5 |
| Madeira........................... | 32 38 N. | 19 8 | 17 5 | 22 0 |
| Algiers ............................ | 36 47 | 21 6 | 16 5 | 26 7 |
| Cairo ............................... | 30 2 | 22 2 | 14 5 | 29 5 |
| Rio Janeiro .................... | 22 54 S. | 23 4 | 20 7 | 26 1 |
| Havannah......................... | 23 9 N. | 25 5 | 22 0 | 28 5 |
| Port Louis (Mauritius)...... | 20 10 S. | 25 7 | 23 0 | 28 5 |
| Calcutta ........................ | 22 33 N. | 26 4 | 19 5 | 28 5 |

## TABLE OF THE ELEVATION ABOVE THE SEA OF VARIOUS PLACES.

| | Metres* |
|---|---|
| Mont Blanc | 4810 |
| Pic du Midi | 2877 |
| Hospice of St. Bernard | 2491 |
| Hospice of St. Gothard | 2075 |
| Pass of Mont Cenis | 2066 |
| Pass of the Simplon | 2005 |
| Puy de Sancy (Mont Dore) | 1886 |
| Puy de Dôme | 1465 |
| Le Ballon (Vosges) | 1429 |
| Vesuvius | 1198 |
| Madrid | 608 |
| Munich | 538 |
| Clermont-Ferrand | 411 |
| Geneva | 372 |
| Moscow | 300 |
| Turin | 230 |
| Dijon | 217 |
| Prague | 179 |
| Lyons (Rhone) | 163 |
| Vienna (Austria) | 133 |
| Toulouse (Haute Garonne) | 132 |
| Milan | 128 |
| Rome | 46 |
| Berlin | 40 |
| Paris (zero of the Pont de la Tournelle) | 26·5 |

### ADOUR.

| | Metres |
|---|---|
| Campan | 676 |
| Tarbes | 302 |

### ALLIER.

| | Metres |
|---|---|
| Vichy | 245 |
| Moulins | 210 |
| At the mouth | 178 |

### DOUBS.

| | Metres |
|---|---|
| Pontolier | 811 |
| Besançon | 236 |
| Dôle | 197 |

### DURANCE.

| | Metres |
|---|---|
| Briançon | 1249 |
| Embrun | 790 |
| Sisteron | 466 |
| Orgon | 70 |
| At the mouth | 13 |

### ESCAUT.

| | Metres |
|---|---|
| At the source | 90 |

### GARONNE.

| | Metres |
|---|---|
| Saint Béat | 538 |
| Saint Gaudens | 367 |
| Toulouse | 132 |
| Bordeaux | 1 |

### ISÈRE.

| | Metres |
|---|---|
| Grenoble | 230 |

### LOIRE.

| | Metres |
|---|---|
| Roanne | 267 |
| Nevers | 178 |
| Orléans | 92 |
| Blois | 80 |
| Tours | 48 |
| Saumur | 40 |

### LOT.

| | Metres |
|---|---|
| Cahors | 160 |
| At the mouth | 64 |

### MARNE.

| | Metres |
|---|---|
| Saint Dizier | 135 |
| Châlons-sur-Marne | 78 |
| Epernay | 69 |
| At the mouth | 31 |

### MEUSE.

| | Metres |
|---|---|
| Near Donremy | 269 |
| Commercy | 240 |
| Verdun | 204 |
| Mézières | 146 |
| Givet | 100 |

### MOSELLE.

| | Metres |
|---|---|
| At the source | 725 |
| Epinal | 317 |

---

* A metre is 3 feet 3 inches.

| | Metres |
|---|---|
| Toul | 204 |
| Metz | 168 |

### OISE.

| | |
|---|---|
| La Fère | 51 |
| At the mouth | 35 |

### RHINE.

| | |
|---|---|
| Basle | 254 |
| Kehl | 146 |
| Manheim | 92 |
| Mayence | 83 |
| Coblentz | 54 |
| Bonn | 42 |
| Cologne | 37 |
| Dusseldorf | 27 |
| Arnheim | 9 |

### RHONE.

| | |
|---|---|
| Lake of Geneva | 375 |
| At the mouth of the Saône | 162 |
| Valence | 106 |
| Pont Saint Esprit | 31 |
| Avignon | 14·5 |
| Beaucaire | 4·7 |
| Arles | 2·2 |

### SAONE.

| | |
|---|---|
| At the source | 396 |
| Gray | 208 |
| Châlons | 173 |
| Mâcon | 170 |
| At the mouth | 162 |

### SEINE.

| | |
|---|---|
| At the source | 471 |
| Troyes | 101 |
| Melun | 37 |
| Paris | 30 |
| Rouen | 1 |

### YONNE.

| | |
|---|---|
| Auxerre | 95 |
| Sens | 66 |

### MINÉRAL SOURCES.

| | Metres |
|---|---|
| Saint Moritz (Switzerland) | 1726 |
| Louesche (Switzerland) | 1412 |
| Baréges | 1270 |
| Mont Dore | 1052 |
| Saint Gervais (Savoy) | 1000 |
| Cauterets | 992 |
| Gastein (Austria) | 877 |
| La Bourboule | 857 |
| Eaux Chaudes | 775 |
| Saint Sauveur | 770 |
| Ax | 710 |
| Pfeffers (Switzerland) | 668 |
| Eaux Bonnes | 638 |
| Bagnères de Luchon | 628 |
| Marienbad (Bohemia) | 606 |
| Bagnères de Bigorre | 567 |
| Ischl (Austria) | 498 |
| Eger Franzensbad (Bohemia) | 492 |
| Allevard | 475 |
| La Motte | 475 |
| Plombières | 421 |
| Karlsbad (Bohemia) | 370 |
| Schinznach (Switzerland) | 338 |
| Luxeuil | 322 |
| Bains (Vosges) | 306 |
| Schlangenbad (Nassau) | 281 |
| Bourbonne les Bains | 280 |
| Bourbon l'Archambault | 270 |
| Vichy | 245 |
| Aix (Savoy) | 251 |
| Néris | 240 |
| Canstatt (Wurtemburg) | 209 |
| Nauheim | 207 |
| Toeplitz (Bohemia) | 200 |
| Baden-Baden | 193 |
| Niederbronn | 192 |
| Hombourg (Hesse) | 188 |
| Kissingen (Bavaria) | 185 |
| Soden (Nassau) | 137 |
| Pyrmont (Waldeck) | 126 |
| Wiesbaden (Nassau) | 101 |
| Ems (Nassau) | 91 |
| Kreuznach (Prussia) | 90 |
| Bath | 5 |
| Bristol | 2 |

# LIST OF SPAS DESCRIBED IN THE WORK.

Page
Acqui (Piedmont), thermal, sulphurous—mud baths . . . . . . 326
Airthrey (Scotland), saline chalybeate . . . . . . . . . . . 335
Aix (Provence), thermal . . . . . . . . . . . . . . 227
Aix (Savoy), thermal, sulphurous . . . . . . . . . . . . 304
Aix-la-Chapelle (Germany), thermal, sulphurous, saline . . . . 238
Aldfield (England), feebly sulphurous . . . . . . . . . . . 92
Allevard (France), thermal, sulphurous . . . . . . . . . . 230
Allyre (Central France), tepid, saline . . . . . . . . . . . 195
Amélie les Bains (Pyrénées), thermal, sulphurous . . . . . . . 186
Askerne (England), sulphurous, saline . . . . . . . . . . 95
Ashby-de-la-Zouch (England), saline . . . . . . . . . . . 121
Audinal (Pyrénées), thermal, ferruginous . . . . . . . . . 187
Astus (Pyrénées), tepid, ferruginous . . . . . . . . . . . 187
Avène (France), thermal, saline . . . . . . . . . . . . 226
Ax (Pyrénées), thermal, sulphurous . . . . . . . . . . . 185
Baden (Austria), thermal, sulphurous . . . . . . . . . . . 282
Baden (Switzerland), thermal, sulphurous, saline . . . . . . . 320
Baden-Baden (Baden), thermal, saline . . . . . . . . . . 260
Bagnères de Bigorre (Pyrénées), thermal, saline . . . . . . . 189
Bagnères de Luchon (Pyrénées), thermal, sulphurous . . . . . . 182
Bains (East of France), thermal . . . . . . . . . . . . 220
Balaruc (France), thermal, saline . . . . . . . . . . . . 225
Barbotan (France), thermal, sulphurous . . . . . . . . . . 223
Baréges (Pyrénées), thermal, sulphurous . . . . . . . . . 180
Bassang (East of France), chalybeate, saline . . . . . . . . 221
Bath (England), thermal, saline . . . . . . . . . . . . 140
Beulah (England), saline, alterative . . . . . . . . . . . 137
Bilin (Bohemia), saline, alkaline . . . . . . . . . . . . 299
Birmenstorf (Switzerland), saline . . . . . . . . . . . . 322
Bocklet (Bavaria), chalybeate . . . . . . . . . . . . . 275
Bonnes (Pyrénées), thermal, sulphurous . . . . . . . . . . 173
Bourbon Lancy (Central France) . . . . . . . . . . . . 208
Bourbon l'Archambault, thermal, saline . . . . . . . . . . 206
Bourbonne (East of France), thermal, saline . . . . . . . . 212
Bourboule (Central France), thermal, saline . . . . . . . . . 194
Bournemouth (England), chalybeate . . . . . . . . . . . 165

Page
Brighton (England), chalybeate . . . 163
Butterby (England), sulphurous, saline . . . 64
Buxton (England), tepid . . . 104
Campagne (France), tepid . . . 224
Castèra Verduzan (France), tepid, sulphurous . . . 224
Cauterets (Pyrénées), sulphuretted saline . . . 175
Charbonnière (France), chalybeate . . . 231
Chaudes Aigues (Centre of France), thermal . . . 195
Cheltenham (England), saline chalybeate . . . 125
Clifton (England), tepid, saline . . . 156
Contrexville (Eastern France) . . . 221
Cransac (France), saline, acid . . . 226
Croft (England), saline, sulphurous . . . 62
Dinsdale (England), sulphurous, saline . . . 62
Dorton (England), chalybeate . . . 166
Driburg (Germany), gaseous chalybeate . . . 291
Dumblane (Scotland), saline . . . 331
Eaux Bonnes (Pyrénées), sulphurous, saline . . . 173
Eaux Chaudes (Pyrénées), sulphurous, saline . . . 175
Eger (Franzensbad), saline chalybeate, gaseous . . . 295
Ems (Nassau), alkaline, saline . . . 254
Enghien (France), sulphurous . . . 235
Epsom (England), saline . . . 133
Evian (Switzerland), mild . . . 308
Filey (England), saline chalybeate . . . 69
Forges (France), saline chalybeate . . . 234
Franzensbad (Bohemia), saline chalybeate . . . 295
Frederickshall (Saxe-Meiningen), saline sulphates . . . 300
Gainsborough (England), feeble chalybeate . . . 64
Gastein (Tyrol), thermal . . . 276
Gilsland (England), sulphurous . . . 57
Gleichenberg (Styria), alkaline, saline . . . 281
Gloucester (England), saline . . . 123
Gréoulx (France), thermal, chalybeate . . . 228
Hampstead (England), chalybeate . . . 137
Harrowgate (England), sulphurous, saline . . . 73
Hastings (England), chalybeate . . . 164
Hauterive (Central France), alkaline . . . 204
Heilbrunn (Bavaria), gaseous saline . . . 276
Hockley (England), saline . . . 137
Horley Green (England), chalybeate . . . 97
Hombourg (Hesse), saline chalybeate . . . 258
Hovingham (England), feebly sulphurous . . . 93
Inverleithen (Scotland), saline . . . 335

Page
Ischl (Tyrol), brine spring 281
Kilburn (England), saline 135
Kissingen (Germany), saline 267
Kreuznach (Germany), saline 241
Kronthal (Nassau), chalybeate 25
Labassière (Pyrénées), sulphurous 190
La Motte (France), thermal, saline 230
Lavey (Switzerland), thermal, sulphurous 309
Leamington (England), saline 123
Liebenzell (Bavaria), thermal, saline 276
Lippspringe (Westphalia), gaseous saline 291
Leuken (Loeche) (Switzerland), thermal 310
Lucca (Italy), thermal, saline 327
Luxeuil (Eastern France), thermal, saline 218
Malton (England), chalybeate 95
Malvern (England), mild 160
Matlock (England), mild 116
Marienbad (Bohemia), chalybeate, gaseous, saline 292
Melksham (England), saline 133
Moffat (Scotland), sulphurous chalybeate 332
Mont Dore (Central France), thermal, saline 191
Monte Catini (Tuscany), tepid, saline 327
Nauheim (Hesse), saline 259
Nèris (Central France), thermal, alkaline 204
Neyrac (France), tepid, saline 227
Niederbronn (France), tepid, saline 231
Olette (Pyrénées), thermal, sulphurous 186
Passy, (France), chalybeate, saline 235
Penticosa, (Spain), thermal 325
Pfeffers (Switzerland), thermal 315
Pitkeathly (Scotland), sulphurous, saline 330
Plombières (Eastern France), thermal 215
Pouges (France), tonic saline 210
Pullna (Germany) 299
Pyrmont (Germany), chalybeate 290
Rennes (France), thermal, saline chalybeate 224
Royat (Central France), thermal, alkaline chalybeate 195
Sadler's Wells, Islington (England), chalybeate 138
Saidschutz (Germany), saline 299
St. Alban (France), gaseous 230
St. Amand (France), mud baths 232
St. Galmier (France), gaseous alkaline 230
St. Gervais (Switzerland), thermal, sulphurous 307
St. Honoré (Central France), thermal, sulphurous 209

| | Page |
|---|---|
| St. Sauveur (Pyrénées), thermal, sulphurous | 180 |
| St. Victoire (Central France), thermal, alkaline | 194 |
| Sandrock, Isle of Wight (England), chalybeate | 165 |
| Saxon (Switzerland), tepid, saline | 309 |
| Scarborough (England), saline chalybeate | 65 |
| Schinznach (Switzerland), thermal, sulphuretted | 322 |
| Schlangenbad (Nassau), thermal | 251 |
| Schwalbach (Nassau), chalybeate | 249 |
| Seidlitz (Germany), saline | 299 |
| Selters (Nassau), gaseous saline | 247 |
| Shap (England), saline | 61 |
| Shotley (England), saline | 61 |
| Soden (Nassau), gaseous saline | 257 |
| Strathpeffer (Scotland), sulphurous, saline | 336 |
| Tarasp (Switzerland), saline | 319 |
| Tenbury (England), saline | 120 |
| Toeplitz (Bohemia), thermal | 297 |
| Tunbridge (England), chalybeate | 161 |
| Tynemouth (England), chalybeate | 61 |
| Uriage (France), tepid, sulphurous, saline | 228 |
| Ussat (Pyrénées), tepid, saline | 188 |
| Vals (France), saline, alkaline | 227 |
| Vernet (Pyrénées), thermal, sulphurous | 184 |
| Vichy (Central France), alkaline, thermal, gaseous | 196 |
| Victoria (England), saline | 121 |
| Vic sur Cère (Central France), alkaline, saline | 196 |
| Vittel (Central France), alkaline | 223 |
| Weilbach (Nassau), sulphurous | 250 |
| Weissemburg (Switzerland), tepid, saline | 314 |
| Wiesbaden (Nassau), thermal, saline | 253 |
| Wildbad (Germany), thermal | 262 |
| Woodhall (England), iodine, saline | 118 |

THE END.

GLASGOW